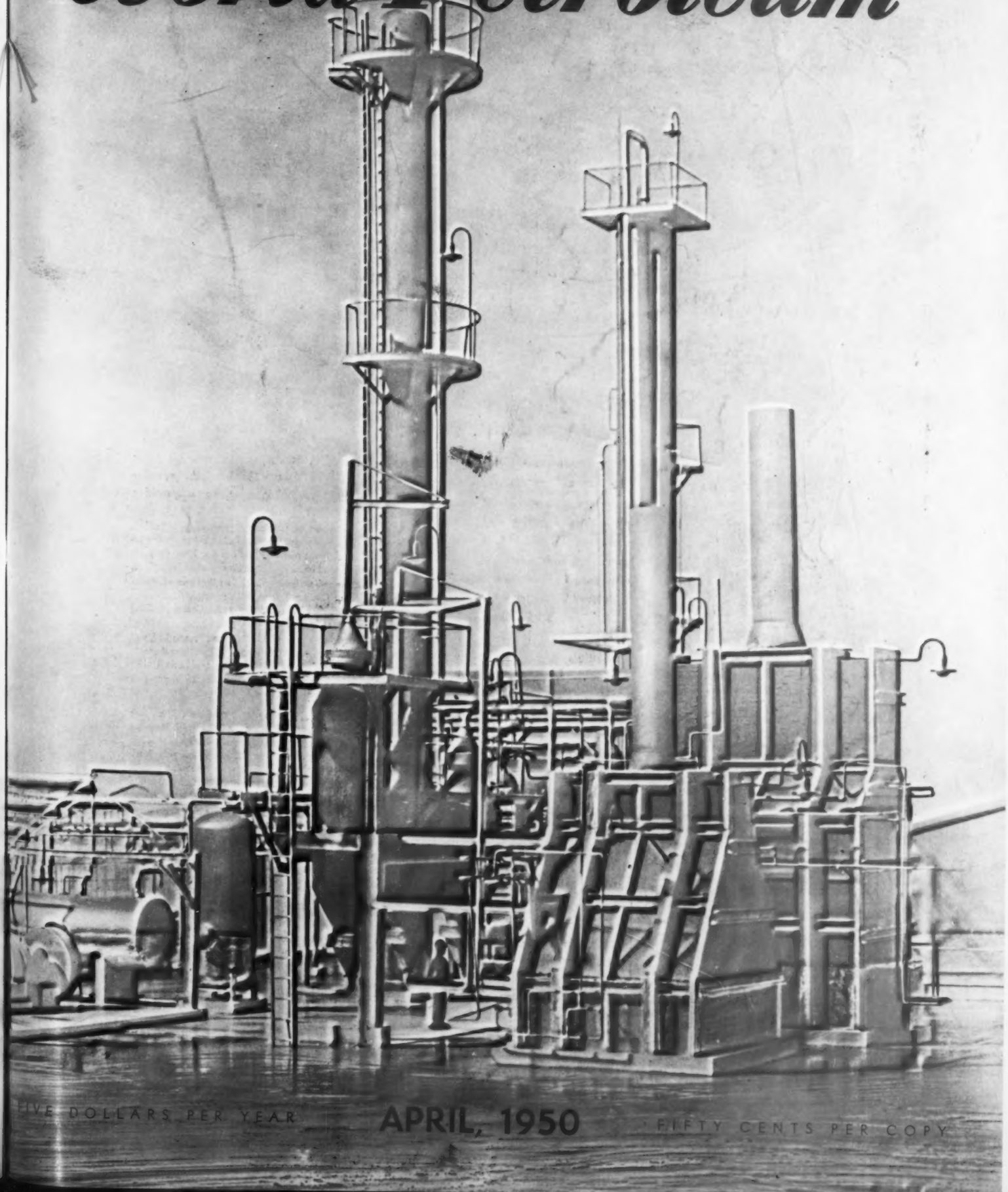
World Petroleum



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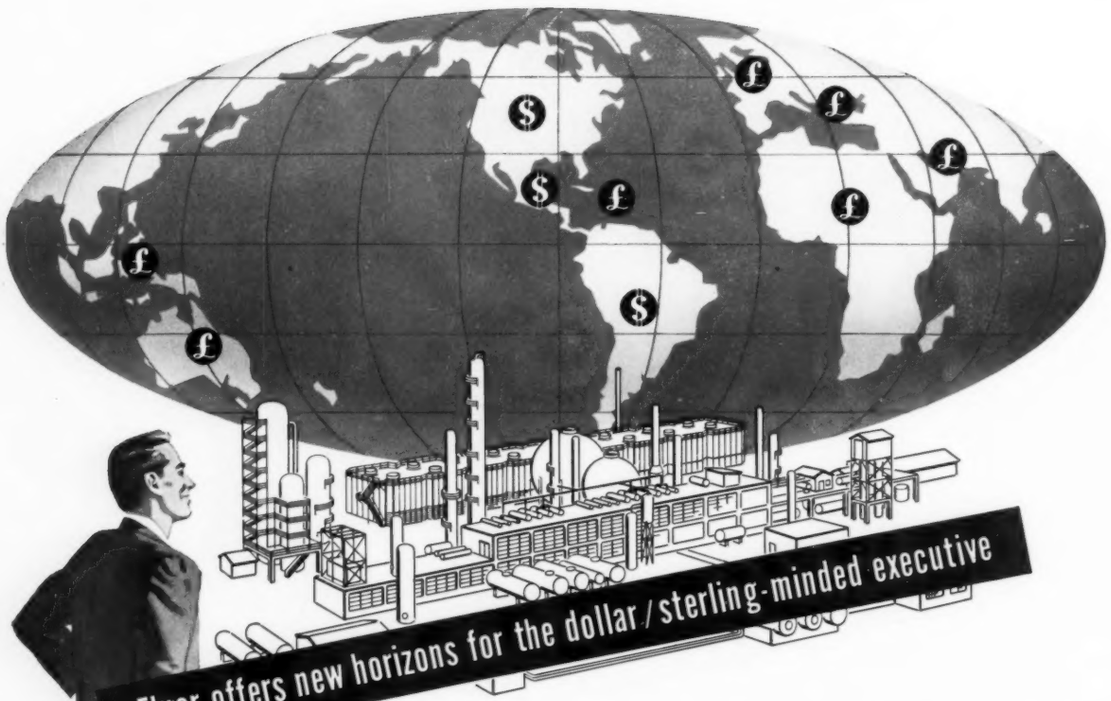


Fluor offers new horizons for the dollar/sterling-minded executive

TO FACILITATE the building of petroleum, chemical and auxiliary plants in the sterling and other areas, The Fluor Corporation, Ltd., is pleased to announce its association with Head Wrightson Processes Ltd., a British Engineering Organization, currently engaged in the engineering, supply and erection of units for Light Oil and Crude Oil Fractionation, Gas Separation, Solvent Extraction, Chemical Treating, Utilities Supply, Carbon Black Production, etc., within the British Commonwealth and other countries.

Unlimited Facilities... The agreement between The Fluor Corporation, Ltd., and Head Wrightson Processes Ltd. opens new fields for capital investment in the sterling and other areas by making available . . .

. . . Process design, engineering, purchasing, progressing, inspection, shipping and erection supervision of petroleum and chemical processing facilities throughout the world by the *combined* staffs of The Fluor Corporation, Ltd., in the United States and Head Wrightson Processes Ltd. in England.

. . . The manufacture and availability in the sterling area of Fluor-designed products including Cooling Towers, both atmospheric and mechanical draft; Fin-Fan Air-Cooled Heat Exchangers; Air-Cooled Mufflers; Pulsation Dampeners and Gas Cleaners.

All Fluor products fabricated by Head Wrightson Process Ltd. will be in strict accordance with Fluor design specifications and will bear the same performance guarantee afforded Fluor products manufactured in the United States. They will be marketed by Head Wrightson Processes Ltd. throughout the sterling area as Fluor products.

A Flexible Agreement... The agreement between The Fluor Corporation, Ltd., and Head Wrightson Processes Ltd., is of such flexibility as to offer the investor a free choice in determining the allocation of available currencies between various phases of a project and in arranging the localization of the engineering and fabrication in the best way to meet attendant circumstances. The most advantageous arrangements, varying from case to case, may be determined during the discussions preceding a contract.

Products and Services offered to the investor under the association between The Fluor Corporation, Ltd., and Head Wrightson Processes Ltd., are payable in some cases entirely in sterling or, in other cases, largely in sterling with a minimum of dollars involved.

FLUOR

BE SURE WITH FLUOR

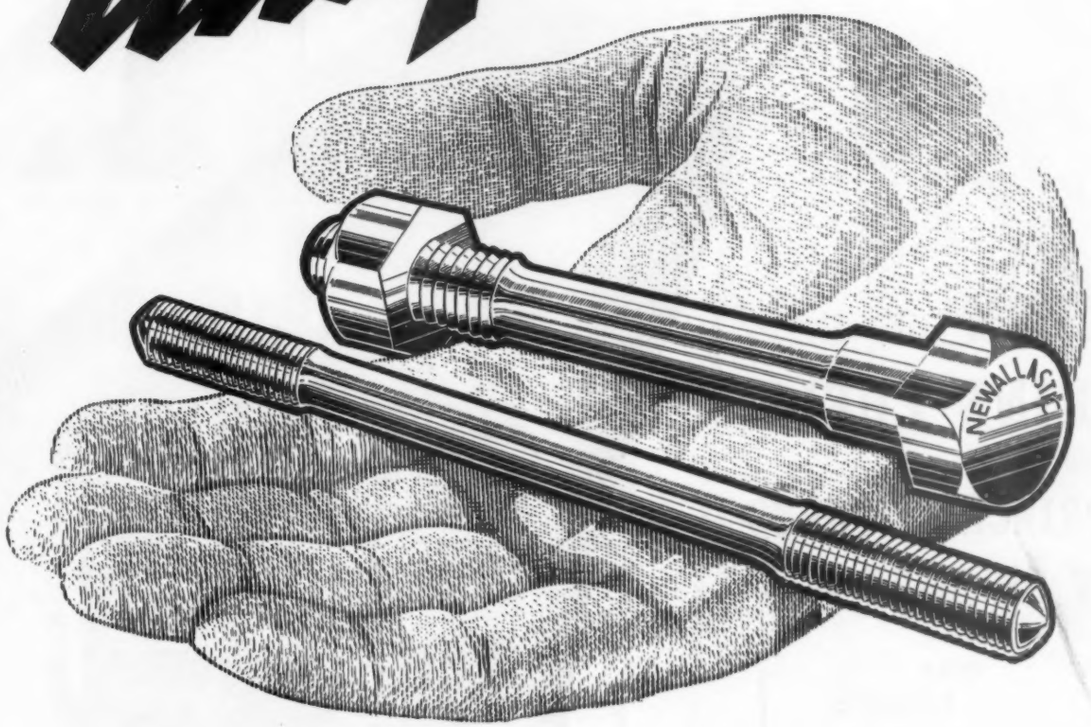
Detailed information on how this association between The Fluor Corporation, Ltd., and Head Wrightson Processes Ltd. can benefit your particular dollar/sterling investment requirements will be gladly furnished upon request to *either* The Fluor Corporation, Ltd., Los Angeles, California, or Head Wrightson Processes Ltd., London, England.

Designers and Constructors of Refinery, Chemical and Natural Gas Processing Units.
Manufacturers of Cooling Towers, Fin-Fan Units, Mufflers, Gas Cleaners and Pulsation Dampeners.

THE FLUOR CORPORATION, LTD. *Los Angeles 22* • NEW YORK • CHICAGO • BOSTON • PITTSBURGH • TULSA • HOUSTON • SAN FRANCISCO

HEAD WRIGHTSON PROCESSES LTD. TEESDALE HOUSE, BALTIC STREET, LONDON, E.C.1, ENGLAND

Unique



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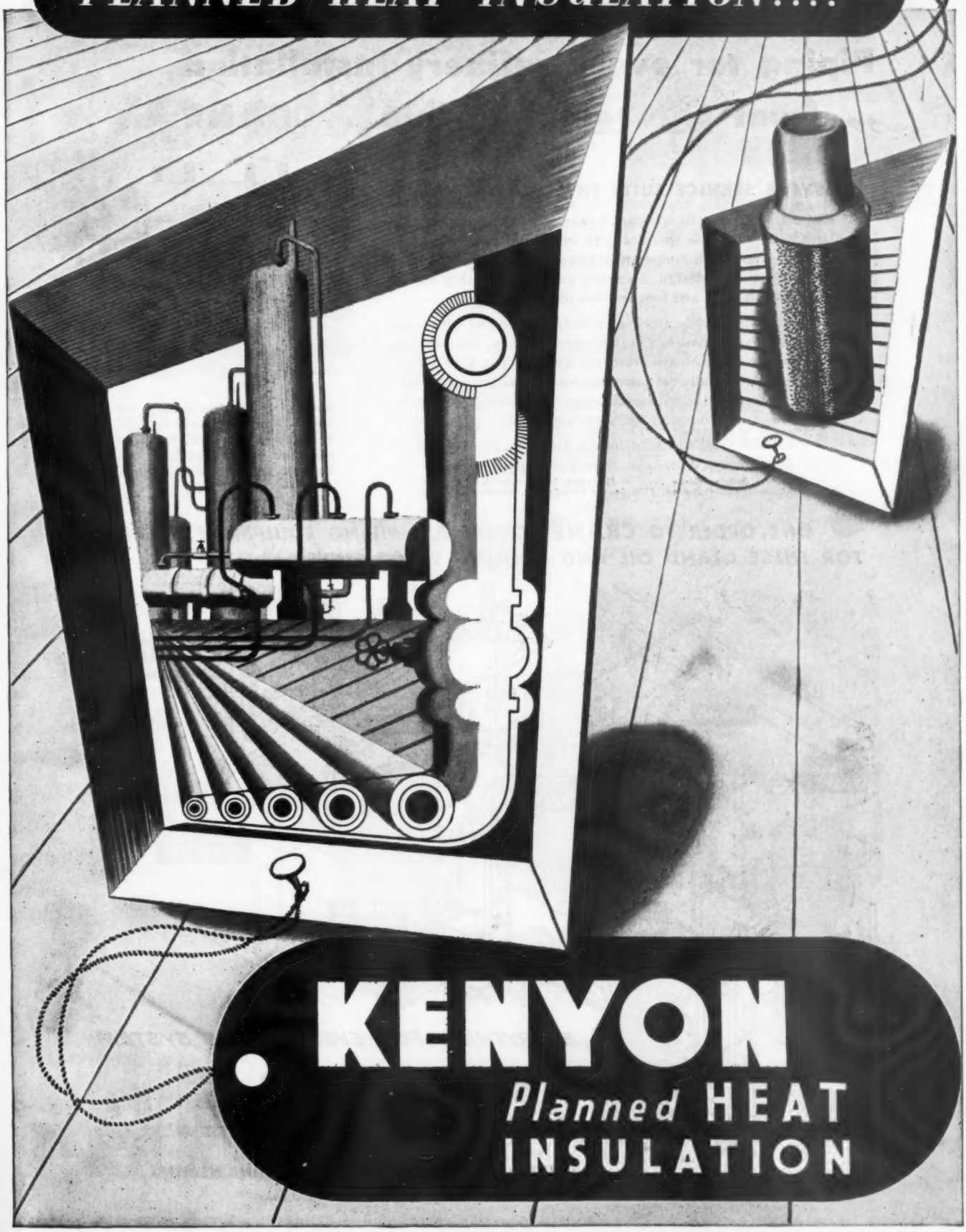

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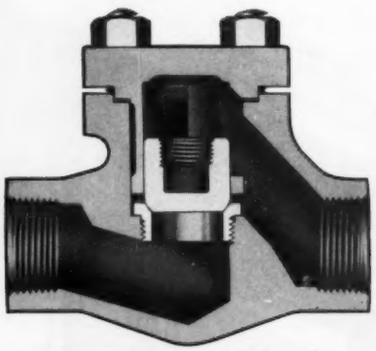

Horizontal Check—Bolted Cap. For oil or oil vapor services up to 1000° F.; for steam up to 850° F. and for water, air or gas. Sizes: ½ to 2 in. Screwed, flanged or welding ends.

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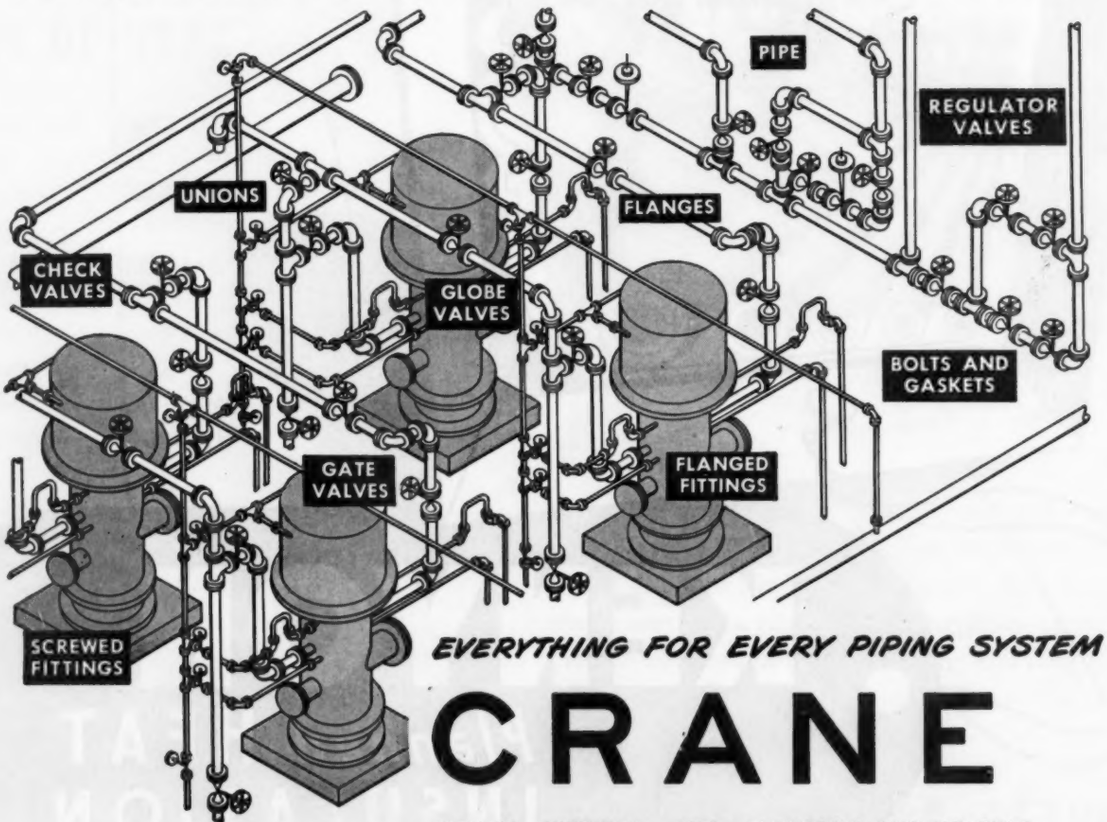

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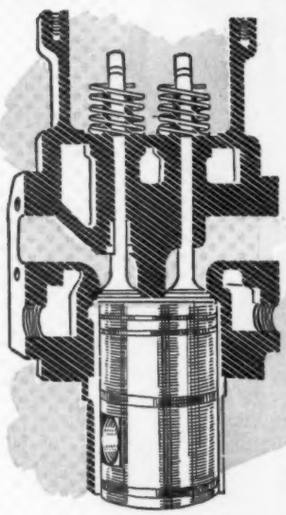
Technically Speaking... by ETHYL



COMPRESSION RATIOS as high as **30** to **1** are being used in an Ethyl engine in research on pure hydrocarbons.

BASIC RESEARCH on combustion characteristics is conducted in a glass-enclosed burner of original design.

DESERT TEMPERATURES are maintained inside this special room and controlled to within 2/10 of 1 degree F. in the study of gasoline stability during storage.

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For Welded Drums etc.

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MODEL P.K.
STATIONARY BEAD
EXPANDING MACHINE

The operation of bead expanding is quicker in action than rolling, and produces beads on drum bodies deeper than is practicable by the rolling method. The bead is drawn up from the length of the drum without undue fatigue or crystallisation of the metal.

Model Q.K. produces beads up to 1½ in. on dia.; drum capacity 10-16 in. dia.; centre of tool to back 15½ in.; 20 B.W.G. material.

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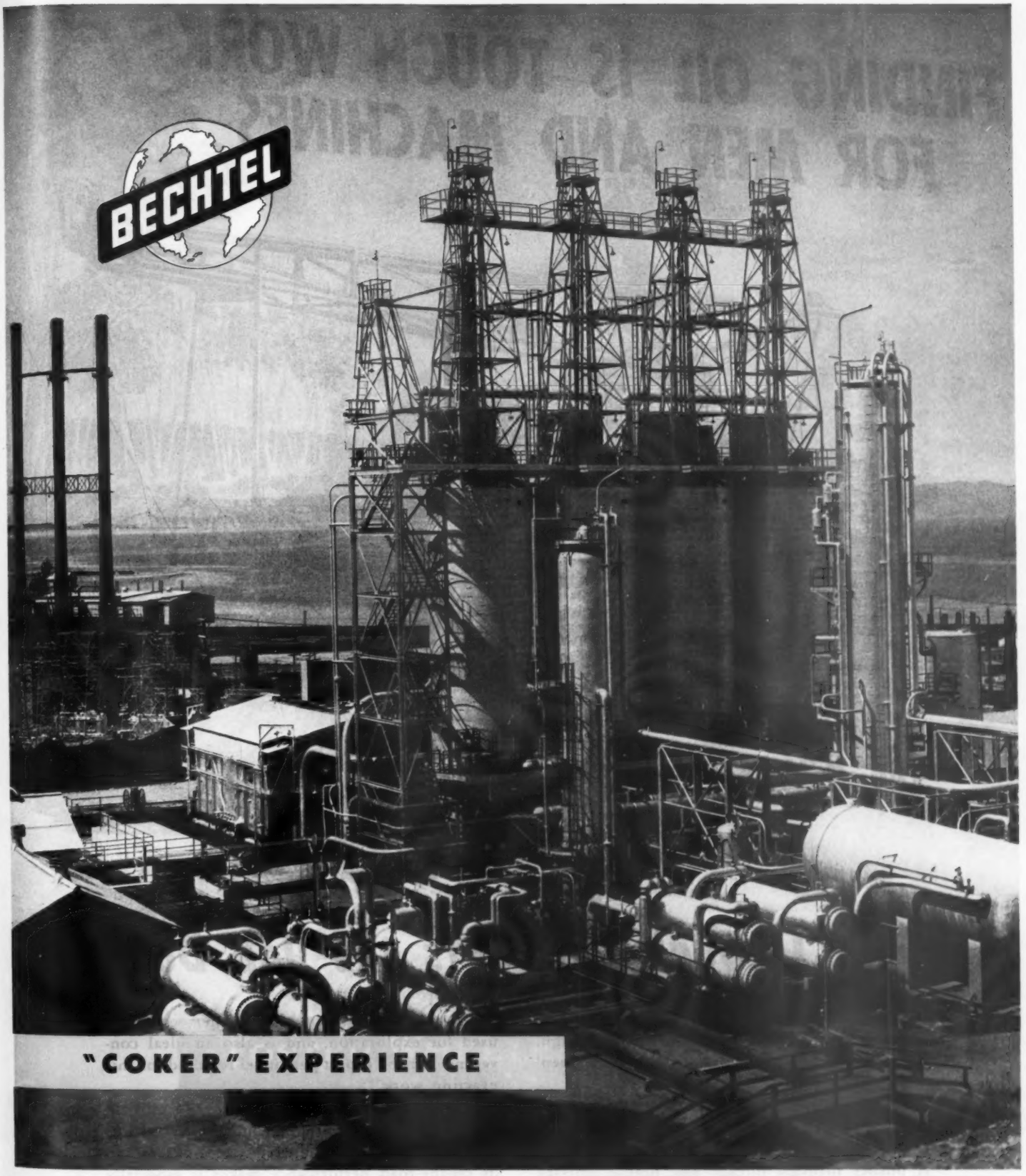

The coker shown above was Bechtel-built in 1942. Currently, Bechtel experience is being applied to coker projects under construction in the midwest and on the Pacific Coast, and is available wherever a refinery development is contemplated.

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"BUILDERS FOR INDUSTRY"

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Gets Through and Gets the Job Done

Nothing requires more stamina of man or machine than the constant search for oil. It is tough, rugged work—just the kind the Universal 'Jeep' is built for.

With its 4-wheel-drive traction and pulling power, the 'Jeep' can travel on or off the road and take exploration crews wherever they must go. It pushes through thicket and jungle, crosses burning deserts and climbs steep mountain trails. It carries various kinds of machinery such as drilling rigs, seismographs and other equipment used for exploration, and is also an ideal conveyance for the expert personnel required for this exacting work.

Geologists, surveyors, land men and oil field superintendents likewise find numerous practical uses for the 'Jeep'. It is a tireless tool pusher and its off-the-road performance makes it especially useful for taking supplies and equipment to remote drilling sites in hard-to-reach places.

WILLYS-OVERLAND EXPORT CORPORATION
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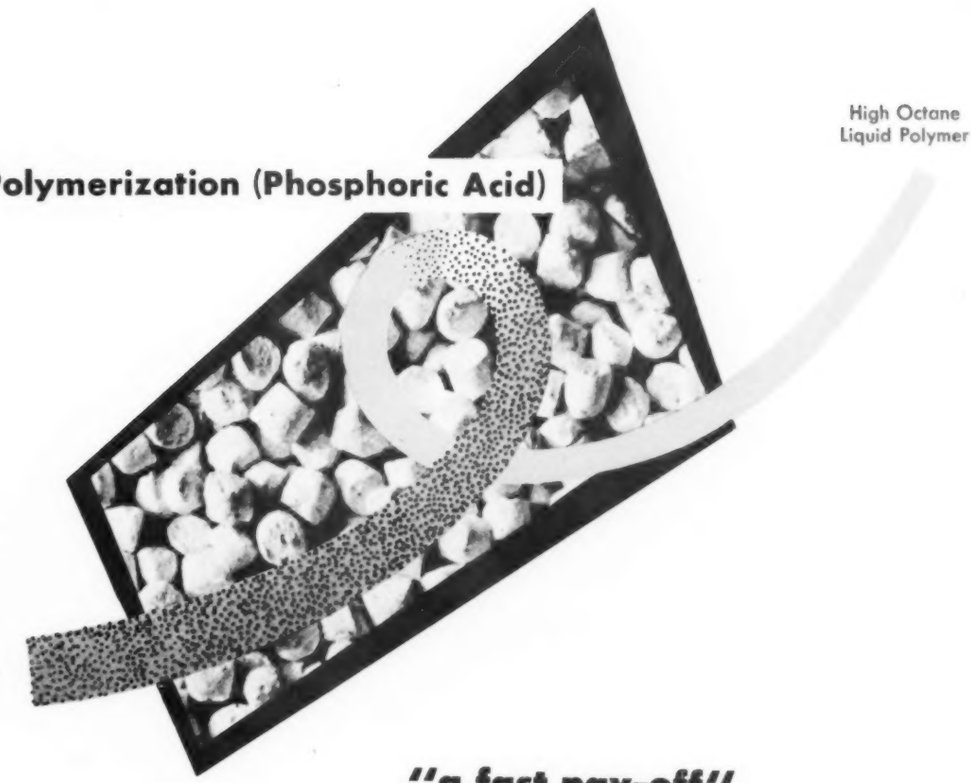

"a fast pay-off"

Catalytic Polymerization (Phosphoric Acid) is probably the most economically attractive process in Petroleum Refining. It is a simple low-cost operation, and if properly designed, will remain on stream for extended periods. A Foster Wheeler designed polymerization unit recently completed 3 years of continuous operation before it was shut down for general inspection.

Foster Wheeler will build within the next year 3 large polymerization units and the design and construction experience gained from these projects is available to other refiners,—anywhere in the world.

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"Out of the sands of Iran"

. . . rises one of the world's largest Fluid Catalytic Cracking Units, designed and constructed by Foster Wheeler.

Four other "Fluid" units (one larger than the Abadan unit in the above illustration) are in various stages of Foster Wheeler design and construction.

design

engineering

fabrication

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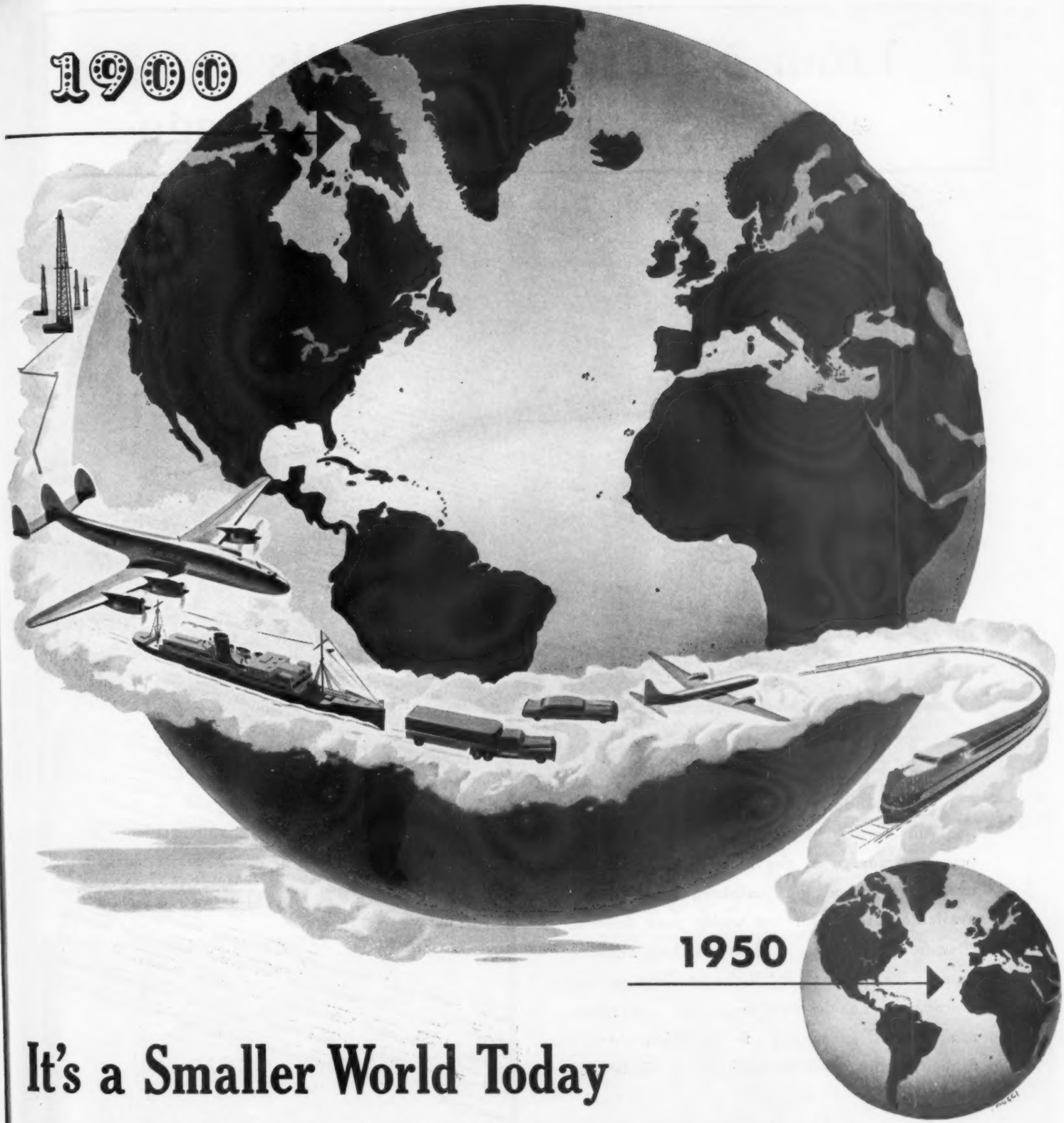


It's a Smaller World Today

Fifty years ago it took over two months to go around the world by the fastest means available. But recently a journalist made the trip in nine days, with time for 400 interviews en route! This shows how the world has grown steadily smaller as transportation by land, sea and air has progressed. Peoples far removed from each other are more easily able to visit back and forth—to exchange goods and services. No longer are the oceans barriers between continents.

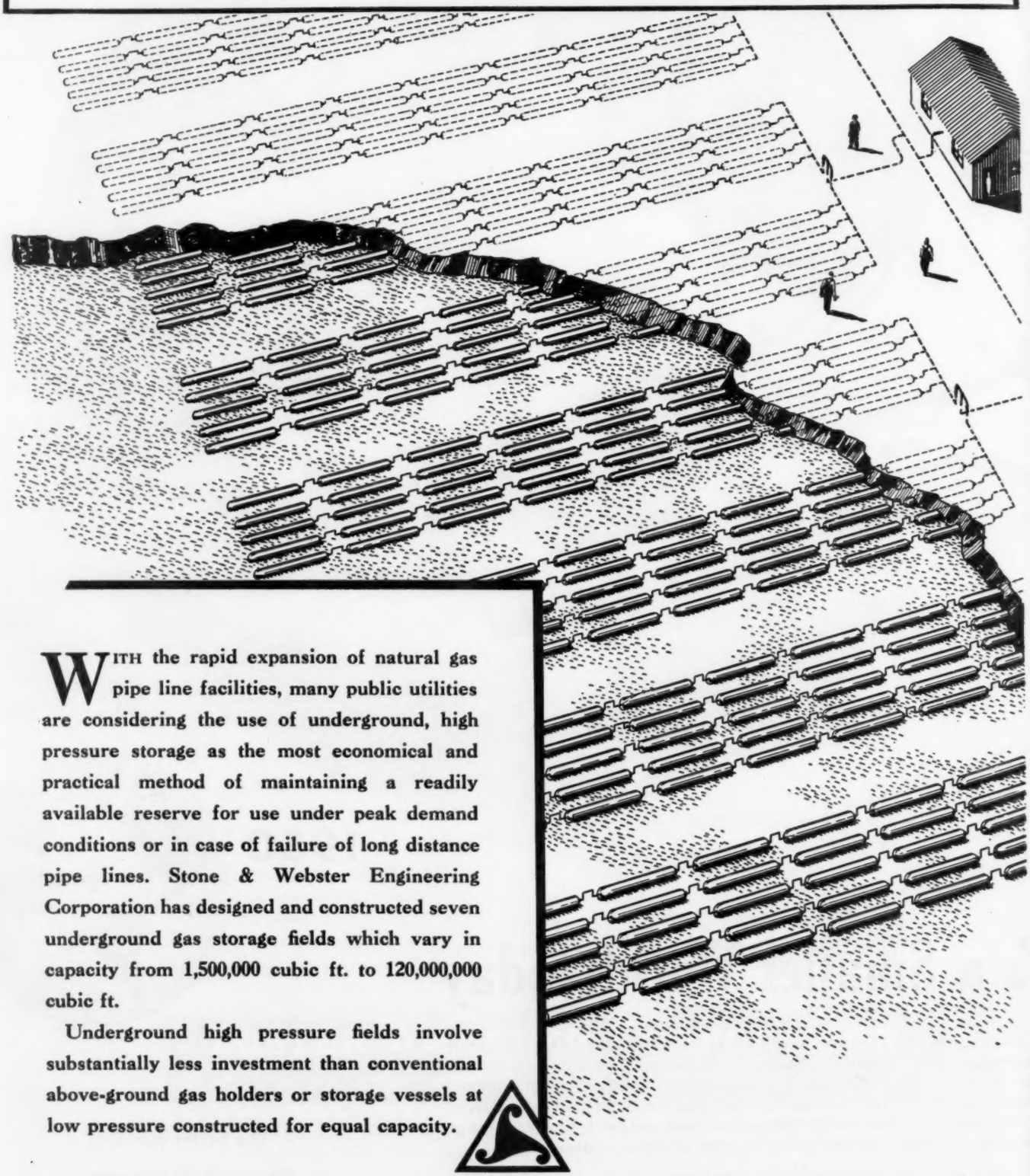
Airplanes and ocean liners now cover the same distances in much less time. Highways have brought nations closer together. This is a remarkable change in the short space of half a century. It has been made possible largely by the internal combustion engine, fueled and lubricated by petroleum products. We are proud to have had an important part in these developments. *Petroleum helps to build a better life.*

The better you live,

the more oil you use...

STANDARD OIL COMPANY
(NEW JERSEY)

From Nature's Gas Wells to Man Made Storage



WITH the rapid expansion of natural gas pipe line facilities, many public utilities are considering the use of underground, high pressure storage as the most economical and practical method of maintaining a readily available reserve for use under peak demand conditions or in case of failure of long distance pipe lines. Stone & Webster Engineering Corporation has designed and constructed seven underground gas storage fields which vary in capacity from 1,500,000 cubic ft. to 120,000,000 cubic ft.

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from the

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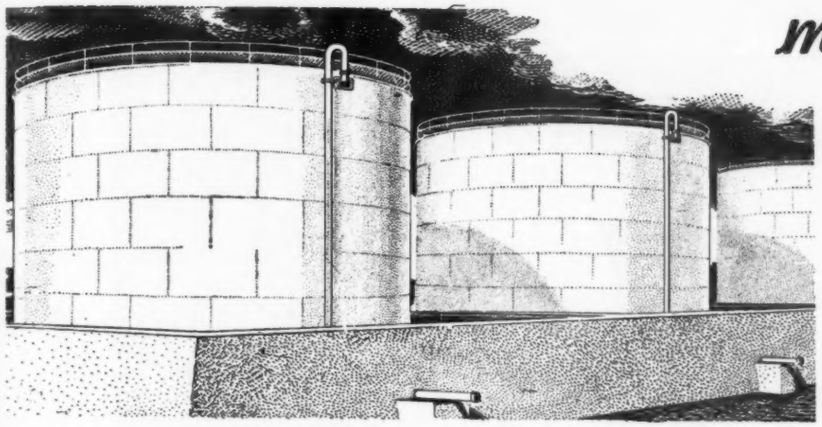
The latest Equipment - *fixed, portable and mobile* - for Oil and Spirit fires

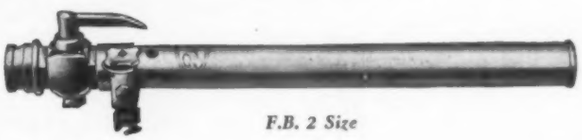


FIXED FOAM INSTALLATIONS. Many years of experience and research have been given to the application of "Pyrene" mechanical Foam to oil storage tank fires. It will pay you therefore to consult us for details of special equipment for this purpose, and advice on the best methods of overcoming fire dangers of this kind.

MECHANICAL FOAM GENERATORS. The range of "Pyrene" Mechanical Foam Generators produces fire-fighting foam of exceptionally high quality in great volume and at a high speed of delivery. Not only are they portable and simple to operate but they have the great advantage that they can pass foam through piped circuits, ordinary canvas fire hose or through vertical pipe-lines and may be operated in a position remote from the fire, if desired. Available in a range of sizes producing up to 2,400 gallons of foam per minute.

M.F.G. 15 Size

FOAM-MAKING BRANCH PIPES. These Mechanical Foam Appliances are extensively used by Fire Brigades, Oil Companies and other industrial concerns which have large oil and spirit fire risks. They produce foam at the end of the water line. The F.B.2. Model shown is a portable unit made in light alloy and is generally used in conjunction with a knapsack tank of 4 gallons capacity. It operates on a water pressure as low as 60 lbs. per sq. inch and gives a foam output of 450 gallons per minute. Made in a variety of sizes with foam outputs varying between 90 and 2,400 gallons of foam per minute.

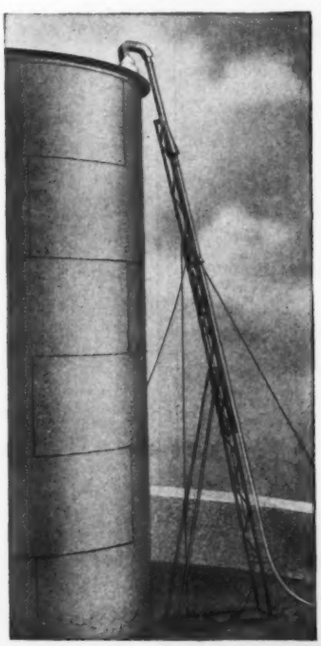


F.B. 2 Size

MECHANICAL FOAM TENDERS. The motor tender illustrated is of a type specially equipped with "Pyrene" fire-fighting apparatus for dealing with oil fires. It is fitted with two M.F.G.15 "Pyrene" Mechanical Foam Generators, each producing 1,250 gallons of foam per minute, a tank carrying 500 gallons of "Pyrene" Foam-making Compound and six 50 lb. CO_2 gas cylinders with two hose reels and distributor horns. The fire pump is of 350/500 g.p.m. capacity. "Pyrene" Foam Tenders are built to suit specific requirements where necessary.

TELESCOPIC FOAM TOWER

This apparatus has been designed primarily for use on floating-roof type tanks and can be used to "back-up" a fixed installation. Being made of light alloy, it is easily manoeuvred and erected by four men, and it is mounted on a two-wheeled chassis for easy transportation. The pouring tube with which it is fitted makes it possible to utilise a manhole or fractured roof plate through which foam can be applied to the burning surface. These towers are made with either fixed No. 20 size Foam-making Branchpipes or for use with "Pyrene" Mechanical Foam Generators.



Pyrene TRADE MARK FIRE APPLIANCES

Full details of these Appliances can be obtained on writing to Dept. W.P. THE PYRENE COMPANY LTD., 9, Grosvenor Gardens, London, S.W. 1 England. *Associated with the Pyrene Manufacturing Company of America.*

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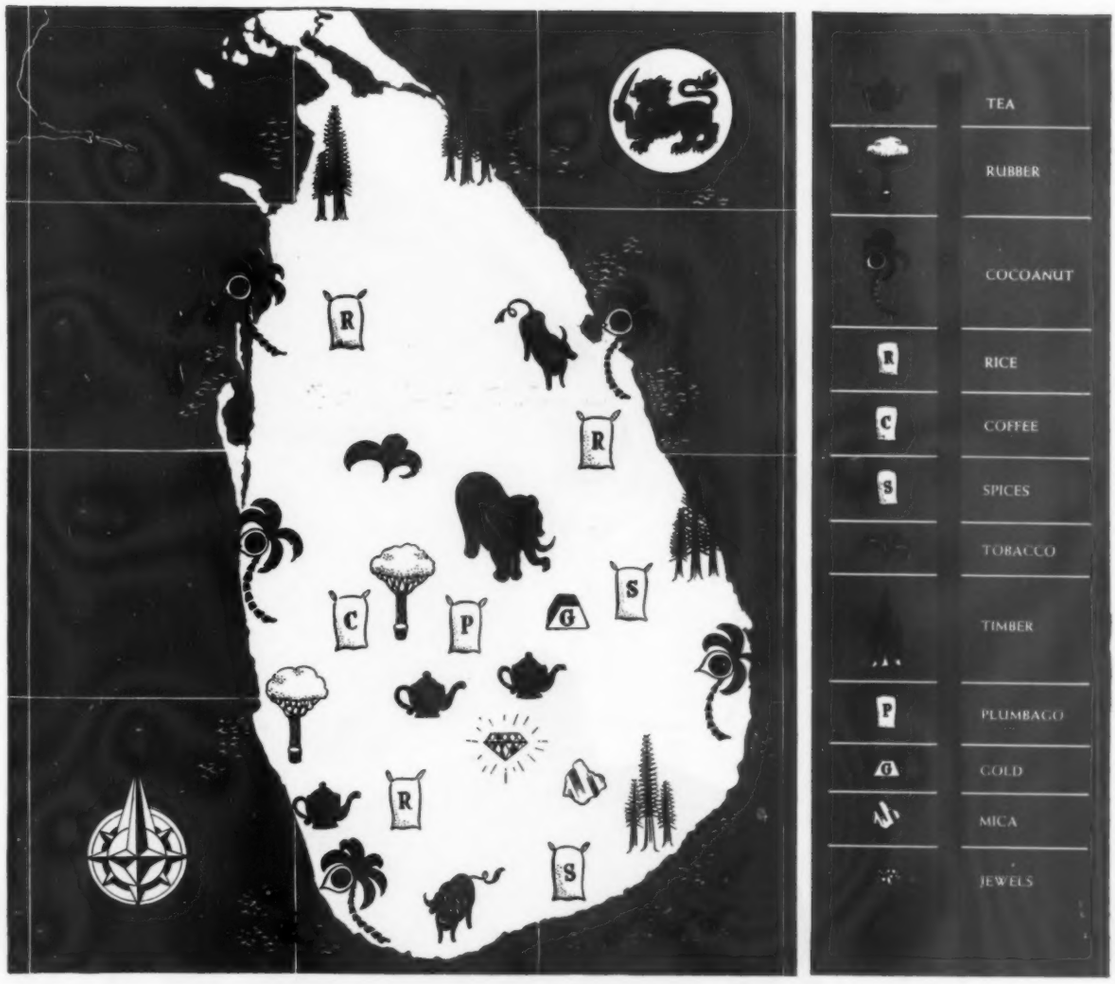

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CEYLON . . . Bright gem in the Indian Ocean, this delightful island has long been admired for its scenery . . . its climate . . . its ancient temples. Ceylon's tea plantations are world-famous . . . its 25,000 square miles of fertile land also yield abundant rubber, cocoanut products, rice, coffee, spices, tobacco and timber . . . its minerals include plumbago, mica, gold and semi-precious jewels. Numbered among important post-war industrial developments in Ceylon are hydro-electric and irrigation projects, steel rolling mills, paper and fertilizer manufacture . . . as well as the expansion and modernization of other industries. Ceylon's 7 million people face the future with confidence.

Standard-Vacuum is proud of the part it plays in supplying the petroleum products so essential to the welfare and continued growth of Ceylon.

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"Where over-all gasoline inventories in this country are approaching an all time high, Old Dutch Refining Company has had no problem in this respect;

e's where

PLATFORMATE

pays off!

Blend *your* gasoline with Platformate, the product of the UOP Platforming process, and watch it pay off . . . in terms of increased gallonage.

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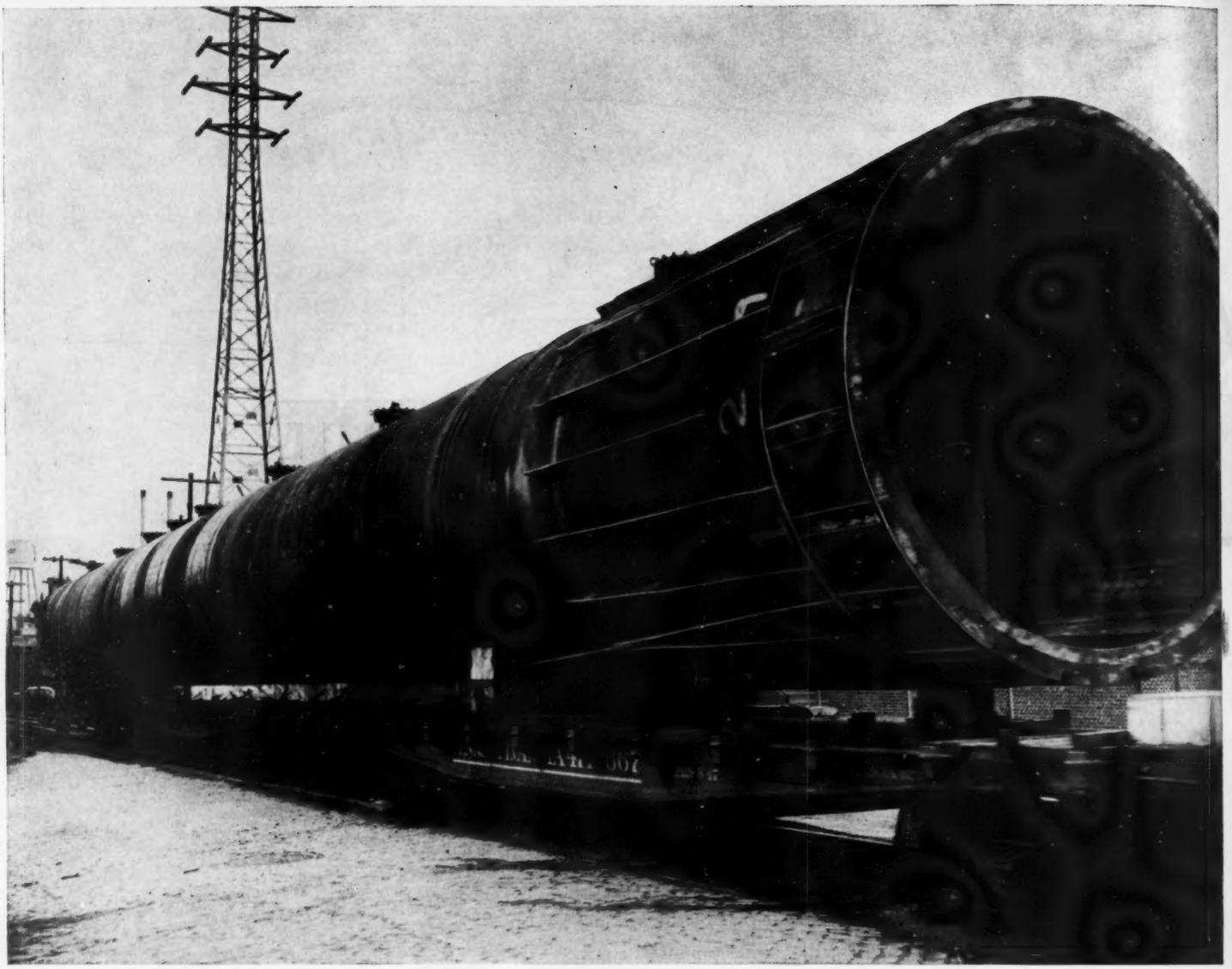

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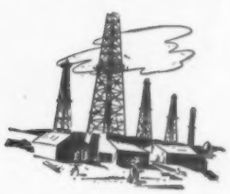

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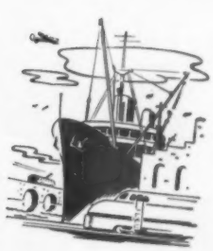
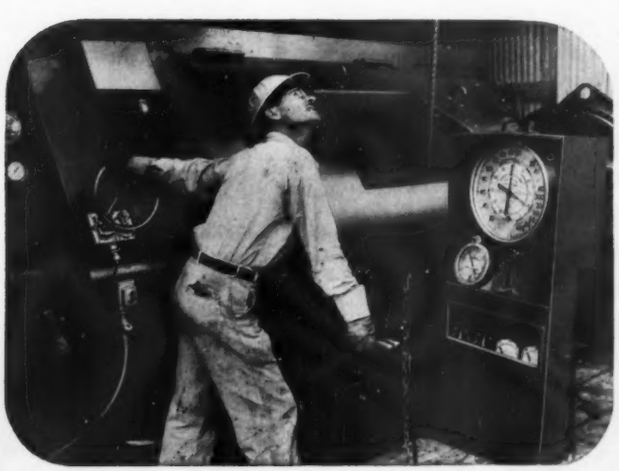
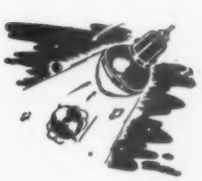




The controls are centralized for easy accessibility.



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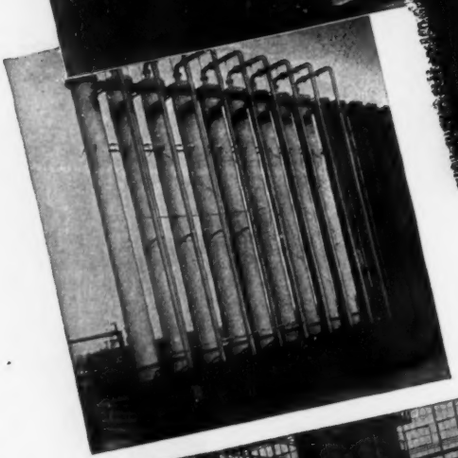

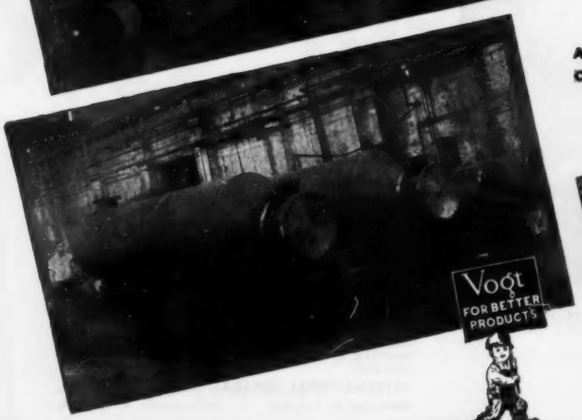

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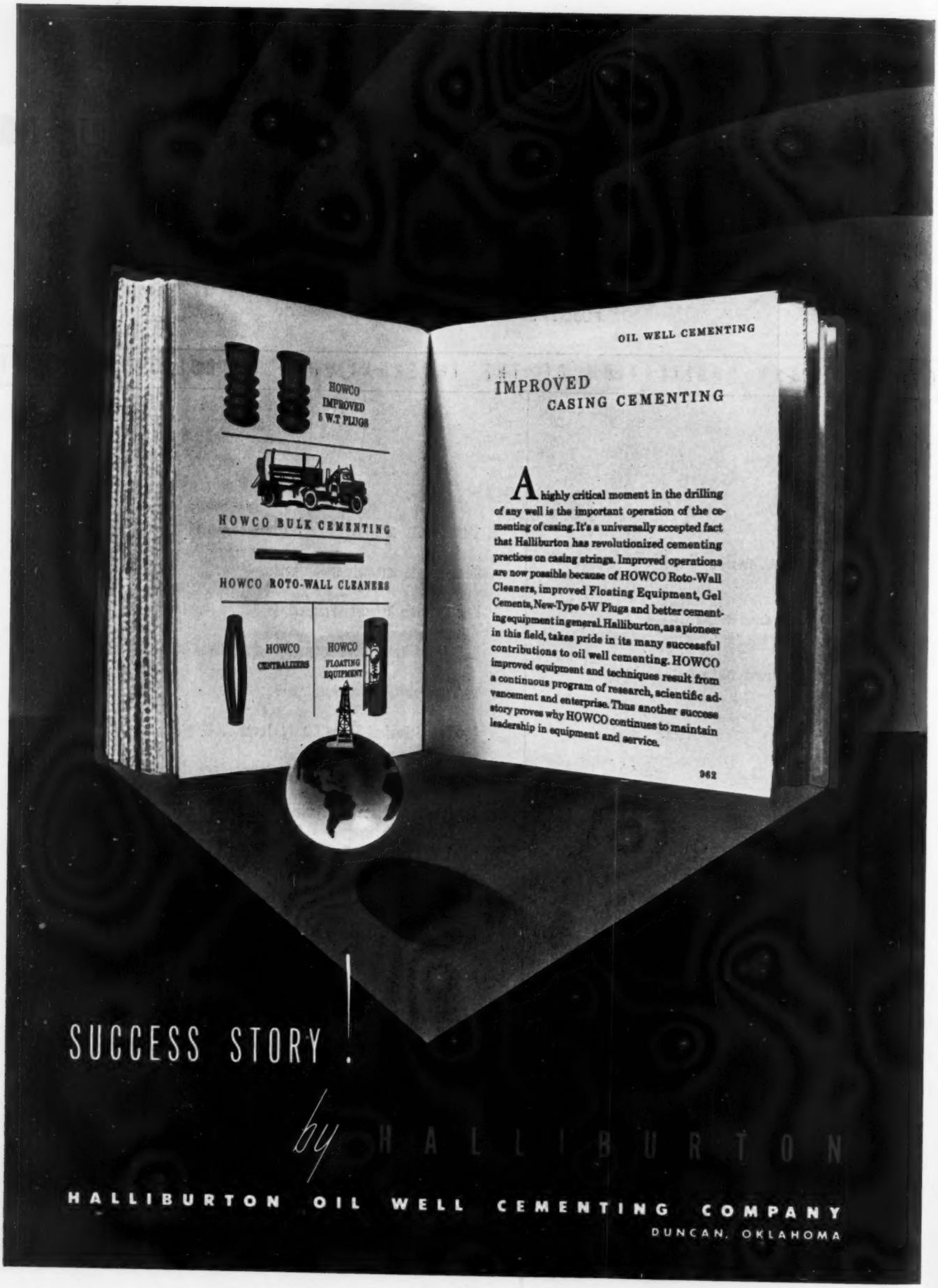
This Month's Cover

Bas relief photograph of a scale model (¼ to one inch) of the first commercial Platforming unit. Model was built by Industrial Models, Arden, Wilmington, Del., for Universal Oil Products Co., Chicago, developers of the Platforming process. Description of the first Platforming unit in operation at Old Dutch Refining Co., Muskegon, Mich., begins on page 30.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EDITORIAL

OIL SUPPLY TO INTERNATIONAL MARKETS

EXAMINATION of the issue raised by the action of the British government in decreeing the replacement of American-owned oil products by British oil in sterling areas reveals that they present no problems that are not soluble without disruption of the international oil trade. Differences of opinion do exist, and American owners of companies engaged in international operations have protested the arbitrary applications of exchange control which they maintain have the effect of excluding them not only from British markets but also bar them from other territories where sterling credits exceed available dollar exchange. The British position is that the measures imposed are necessary to lessen the heavy drain of dollar payments.

The Ministry of Fuel and Power of the British government has taken pains to issue a statement explaining its position. This declaration reiterates that its only purpose is to close the dollar gap that exists year by year in its trade balance. Oil, it is stated, is the largest single item contributing to this imbalance. Because of this Britain has continued wartime restrictions upon petroleum and has reduced American controlled imports. There is now available a surplus of production by British-owned companies beyond the needs of their regular customers, a surplus arising in part from restrictions upon consumption. This situation, it is explained, has led the British government to announce that for the current year it would substitute oil from these sources for 76,000 barrels per day of dollar oil at a saving which it estimates as between $50 and $60 million. Through the exercise of exchange control, Britain has gone further by forbidding the sale of American-owned oil for sterling in other countries and insisting that for such transactions oil must be purchased from British companies. American oil interests estimate that enforcement of this requirement would result in displacing an additional 150,000 to 200,000 barrels daily of their oil.

In the published explanation by the British Ministry of Fuel and Power of its government's present oil policy, it is repeatedly set forth that dollar saving is its only purpose. It makes the flat declaration: "Other things being equal, we should always be ready to give parity of treatment to imports of any United Sates companies' oil which cost us no more dollars than oil of British companies." In other passages it offers to welcome any proposals that will accomplish this result.

In view of this insistence, it would appear that the burden is placed upon the American oil companies of showing that they can meet this requirement. Officials of the American companies assert that, if permitted to operate in sterling areas on the same terms as British competitors, they can bring their dollar costs down to the same level. It is obvious that this is the case in certain areas at least. In Venezuela, for example. British and American companies operate side by side and in some cases produce from the same fields. Payments to the government have to be made in hard currency based on dollars, and the dollar component is estimated both by British and Americans at 60 to 65 percent. In the Middle East the dollar component is much less, but American oil men in that area assert that, given parity in marketing, they can match the British performance. Presumably the discussions now going on in London are directed to this subject.

More is involved in this issue of international oil trade than a possible loss of some millions of dollars to American-owned companies or a delay in closing the dollar gap in Britain's trade balance. Oil is the world's most important strategic product, indispensable to industrial progress. It happens that most of the oil supply of international markets is produced outside the borders of the United States or the British Commonwealth but is produced by companies of American, British and British-Dutch ownership. Exclusion of American-owned oil from established markets, forcing a drastic reduction in its output, would lead to political disturbances in countries in which Americans hold concessions which are the main sources of local government revenue, and to probable ultimate cancellation of these concessions. It is unlikely that the companies would submit to loss of their markets and their huge investments without a struggle. Either such a struggle or the passing of American-owned properties into unfriendly hands would inflict financial losses on all concerned far greater than any possible gain from trade restriction and would vastly weaken the international position of both Britain and America. Quite aside from the private stake involved, the national welfare and security of the western nations should prohibit any such outcome.

In the past two years great progress has been made in narrowing the dollar gap in British-American trade, and Britain's deficit has been reduced by some 2,600 million or 60 percent. The dollar pool has been growing for many months past though still not above the danger line. Too much of the reduction in this deficit has been accomplished by restriction of imports rather than by expansion of exports to dollar areas, but increased sales rather than further restrictions of purchases is the safe road to sound and permanent trade relations.

NEW CATALYTIC REFORMER PRODUCES 82-OCTANE

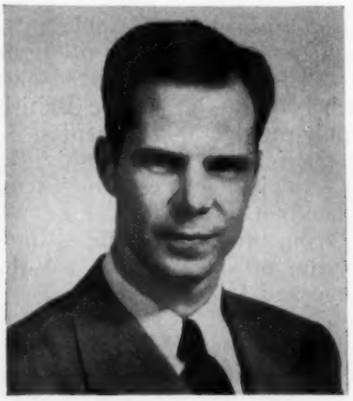
OLD DUTCH Refining Co. at Muskegon, Mich., recently advertised that it was "first in the world with Platformed gasoline." Since announcement of the new product appeared, Cadillacs and Oldsmobiles have been lining up at Old Dutch stations to be served. This is a new experience for Old Dutch which previously had found difficulty in meeting minimum standards for premium gasoline fixed by manufacturers of tetraethyl lead. Drivers of the most critical cars usually avoided the purchase of gasoline made entirely of highly paraffinic Michigan crudes. Because of its competitive disadvantage, Old Dutch gasoline traditionally was sold at cut prices to attract motorists whose cars did not demand the highest octane number levels. In the four months which have elapsed since the new UOP Platforming unit went on stream, Old Dutch has increased its near-by sales to the point where it has been able to withdraw from a highly competitive low-price market in another state and now is considering a basic change in its pricing policies in Michigan.

E. F. Sondregger, vice president and general manager for Old Dutch, had been studying his company's competitive situation with some concern since the close of the war, as other companies with better crudes installed cat crackers and made substantial increases in their octane ratings. Before the war the general octane level in the Middle West had been considerably below the East and West Coast marketing areas, and Michigan refiners were able to meet quality competition fairly well with thermal crackers and thermal reformers with poly units. But with the war and postwar cat cracker building program in the Great Lakes region, the competitive situation became increasingly grave. With a good local market for industrial fuel oil, Old Dutch hesitated to install an expensive small cat cracker, a step two other small Michigan refiners had taken.

A year ago this month Universal Oil Products Co. announced at the annual meeting of the Western Petroleum Refiners Association that it had developed a new catalytic reforming process. Edwin F. Nelson, UOP vice president, stated in a paper that the new platinum-bearing catalyst had achieved remarkable results in pilot plant operation. At the close of the meeting Mr. Sondregger hurried back to Muskegon and obtained approval of Old Dutch directors to erect a plant.

Negotiations with Universal Oil Products Co. and all other preliminaries were completed and a process license agreement and erection contract signed within about six weeks. This may well be a record in the sale of a commercial plant to carry out a new process within about 45 days from the date of announcement of the process. If so, it is just as likely that the construction job set another record because the unit went on stream on October 28, 1949, just 158 days after the contract was signed. Except for the furnace employed to heat naphtha charged to the unit, all design, procurement, fabrication and installation was completed within the 158-day period. Design of the Platforming unit is comparatively simple, a factor of importance in setting any construction record, and therefore procurement was a top-level operation followed closely by expediters.

The UOP Platforming process is a catalytic reforming operation carried on under mild conditions in relatively simple equipment. Since the catalyst is installed in fixed beds and catalytic regeneration is not contemplated, the unit is not complicated by regeneration equipment or cycle timers.



Vladimir Haensel received his B.S. from Northwestern University in 1935 and his M.S. from the Massachusetts Institute of Technology in 1937. He joined Universal Oil Products Company, assisting Professor V. N. Ipatieff. In 1939 he helped to set up the Ipatieff High Pressure Laboratory at Northwestern University. He received his PhD from Northwestern in 1941 and returned to Universal as a research chemist. From February to July 1945 Dr. Haensel inspected the German synthetic oil plants as a member of the technical oil mission for the Petroleum Administration for War. Since August 1945 he has been the coordinator of the cracking research division of Universal Oil Products Company.

In its essentials the plant consists of heaters for a prefractionated naphtha charge and recycle gas, three reactors with intermediate reheating facilities, a gas separator, product stabilizer, compressors for recycle gas and the usual heat exchangers and control equipment. The catalyst is a pelleted, platinum-bearing material of undisclosed composition.

The three major reactions which take place in the Platforming process are being described this month in a paper prepared for presentation before the Western Petroleum Refiners Association by Vladimir Haensel, who is the originator of the process. Dr. Haensel reported these reactions:

(1) Dehydrogenation of naphthenic components of the charge to aromatics with the liberation of hydrogen.

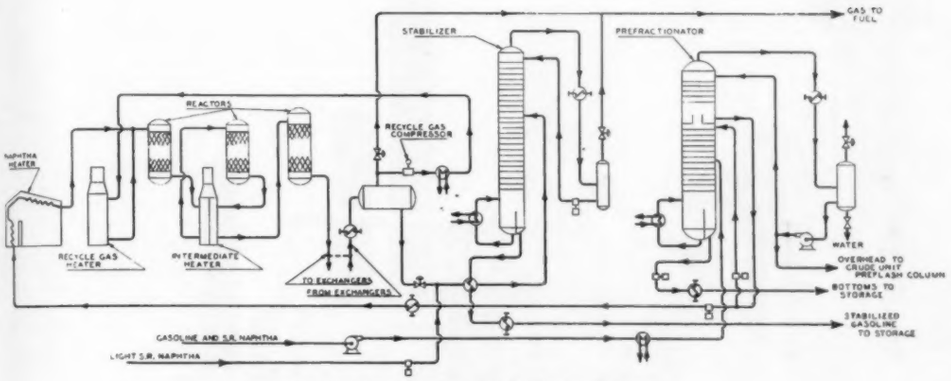
(2) Hydrocracking of straight-chain hydrocarbons. In this reaction hydrogen released in the dehydrogenation step combines with unsaturated hydrocarbons to form new isomers and normal fractions.

(3) Isomerization producing a wide variety of valuable isomers.

Under Platforming conditions the reactions of dehydrogenation of naphthenic hydrocarbons are very rapid, and these reactions contribute substantially to the octane gain and heat of combustion of the gasoline. They are highly endothermic, requiring a high heat input, and they result in some volumetric shrinkage, since the aromatic product is denser than the parent naphthene. Thus, for example, if the charge consisted of pure methylcyclohexane and if it were all converted to toluene, the theoretical yield of toluene would amount to 83.3 percent by volume of the charge with an octane number increase of about 50 units. The naphthenic content of straight-run gasolines varies considerably, but, assuming an average value of about 40 percent, the maximum volumetric yield due to dehydrogenation to aromatics would be about 93 percent, assuming complete conversion and no other reactions.

Another important reaction in Platforming is the opposite of dehydrogenation from the standpoint of yield and heat of reaction. This is the reaction of hydrocracking wherein a high molecular weight hydrocarbon is decomposed into lower molecular weight compounds. This reaction produces isopentane and normal pentane from decane. In actual operation the break in the

FUEL FROM MICHIGAN NAPHTHA



Simplified flow diagram of UOP Platforming unit.

molecule occurs not only in the middle, but also to the right and left of the center, so that butane and hexane as well as propane and heptane also are formed. Assuming for the time being that two pentane molecules are formed, the volumetric yield of such a reaction at 100 percent conversion is 118 percent along with an octane number gain of more than 100 units. There is a small loss to propane and lower hydrocarbons, with the result that only a part of that high gain in volume and octane number can be realized.

It is apparent that the hydrocracking reaction balances the dehydrogenation reaction in that it provides for a lower density product and absorbs a part of the hydrogen which is liberated in the dehydrogenation reaction. The reaction is also exothermic and, therefore, provides some of the heat of reaction required for the dehydrogenation step.

The third major reaction in Platforming is isomerization in which five-membered ring naphthenes undergo isomerization to six-membered ring naphthenes prior to the conversion into aromatics. The composition of the isomerized product is of interest in that nearly every possible heptane isomer is produced.

The hydrocracking reaction which accompanies the isomerization reaction of heptane gives propane and butane as the major products, the isobutane-normal butane ratio in the butane fraction being about one. Both higher and lower paraffins also undergo extensive isomerization.

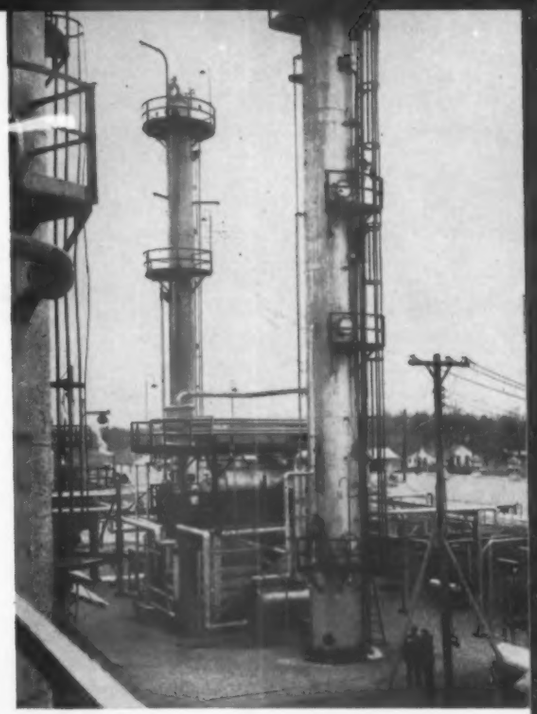
In addition to the three major reactions that occur in Platforming, there are other important reactions. These include dehydrocyclization, wherein paraffins are converted directly to aromatics, and desulfurization, wherein virtually all of the combined sulfur is converted to hydrogen sulfide.

The question naturally arises as to how we balance the extent of the various reactions that take place in Platforming in order to attain the optimum yield octane relationship. This is accomplished primarily by proper selection and preparation of catalyst. Secondarily, the operating conditions are adjusted to give the desired product distribution.

It should be emphasized that Platforming is unique among reforming processes from the standpoint of low methane production. In a process of this kind methane production is undesirable from the standpoint of severe loss of liquid product, high exothermicity of the reaction which forms methane and high hydrogen consumption. The extremely low methane production is beneficial on the basis of high liquid yield and control of the reaction at all times. For example, with other catalysts, a high-pressure condition leads to excessive methane formation and an exothermic condition is reached which is difficult to control. With the Platforming catalyst, on the other hand, a high-pressure operation gives only a small amount of methane, and, as the temperature is increased, the selective hydrocracking reaction is quenched by the dehydrogenation reaction. Thus there is no tendency to develop run-away temperatures in the operation of the Platforming process. In addition it should be pointed out that another undesirable reaction, characteristic of some reforming processes and involving the formation of high

OPERATING COSTS FOR PLATFORMING
1500-2000 BPSD charge

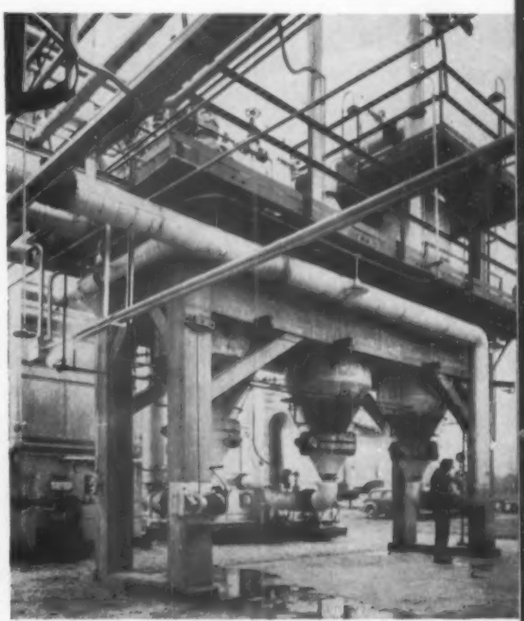
	Cents per Barrel Reactor Charge
Operator and part-time helper	4-5
Maintenance	3-5
Taxes and insurance	4-5
Utilities	4-5
Catalyst	Less than 10
Royalty (escalator)	7
Total	30-37



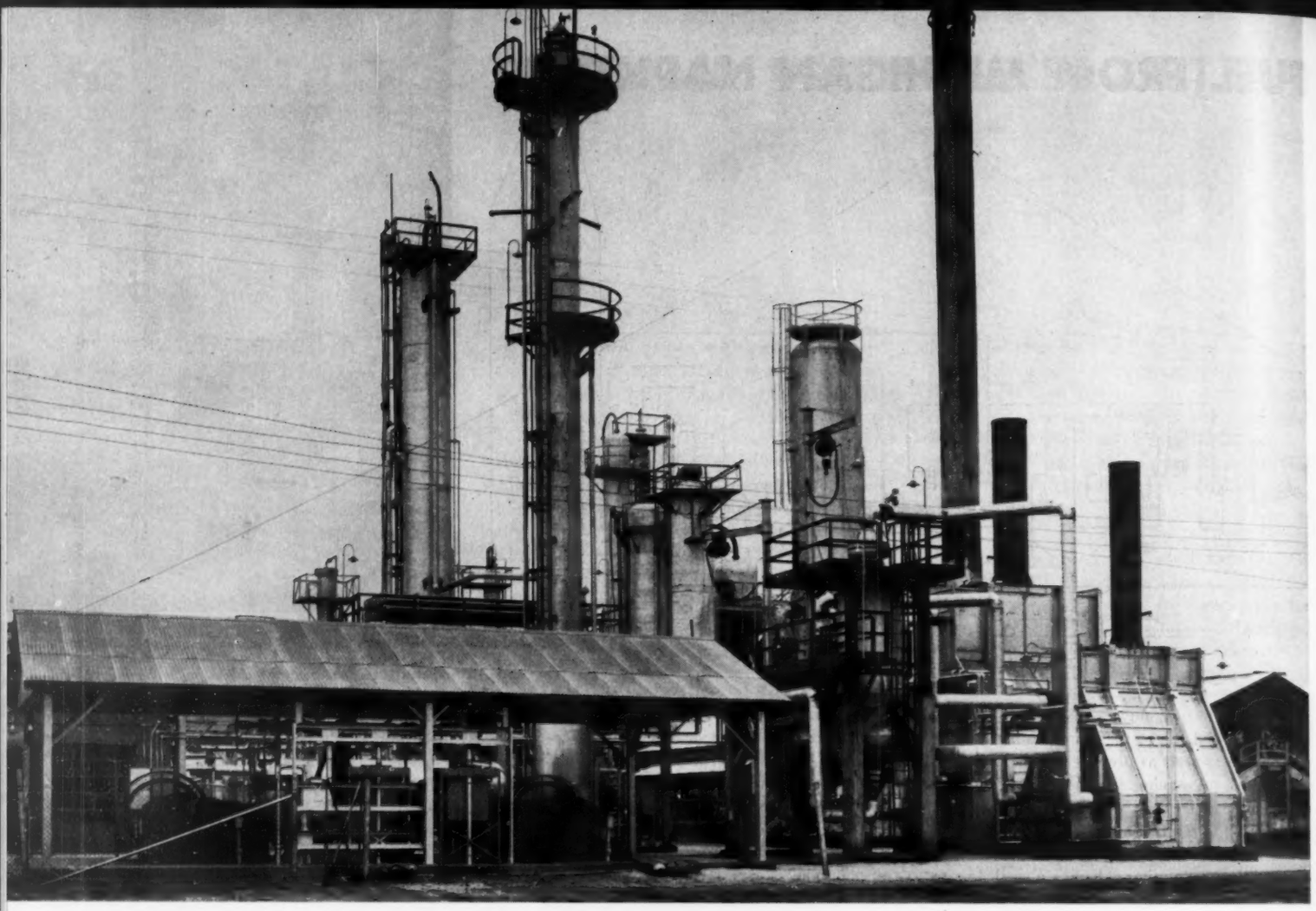
Fractionating columns and exchanger equipment. Column in the foreground is a prefractionator in which light naphtha is stripped from the charge stock. Product stabilizer is in the background.

molecular weight compounds, is essentially eliminated in Platforming. Therefore, Platformates do not require rerunning.

Product of the process known as Platformate is a high-octane, low sulfur blending stock which is highly stable in storage. Sulfur content of charge stock is reduced 82 to 97 percent during the processing. Blending value of the Platformate is higher than its octane test, and motor fuel containing Platformate has a road performance which is better than its Research (F-1) octane rating. Highest boiling point fractions of the Platformate have the highest octane rating, and the lowest boiling point fractions have the lowest octane rating, according to tests conducted by



Three reactors are employed in the process.



General view of process area. Intermediate heater is in the right foreground and immediately behind is the recycle gas heater. At left of the reactors are the two recycle gas compressors.

W. Hatfield, Old Dutch chief chemist. Qualities of the product may be varied over a wide range by selection of processing variables. At present the Platformate tests 82 O.N. (F-1) clear as compared with 74 O.N. for thermally cracked gasoline from the particular crudes run at the Old Dutch plant. Unleaded octane number of the raw naphtha before processing is about 50.

Yield of finished Platformate is a variable depending on the quality of product desired. Normal 10#RVP yield at Old Dutch is 97.1 percent, producing a blending stock testing 94 O.N. leaded. A test was run with an octane rating of 95.8 (F-1) and a yield of over 90 percent. UOP engineers who have been assisting in the operation of the unit assert that they could produce a 100 O.N. blending stock by varying operating conditions. There are four operating variables: temperature, space velocity, total pressure and hydrogen partial pressure. As a practical matter the Old Dutch unit is regulated largely on a temperature basis. Pressure is a less critical variable, but higher pressure does permit a higher hydrogen circulation rate to prevent carbon deposition on the catalyst.

Because of the high concentration of aromatics in the Platformate, the Old Dutch sales department has been approached by users of special naphthas with requests for narrow boiling range cuts. Thus far the company has not completed studies to determine whether installation of fractionating equipment to produce these special cuts would be economic. In certain areas a Platforming unit could produce hydrogen as a by-product, since an excess of this is produced in the dehydrogenation step as compared with consumption in the hydrocracking step.

When the unit first went on stream last October, it was operated with a throughput of about 900 barrels daily. By obtaining charge stock from other adjacent plants, the throughput now has been stepped up to the design capacity of 1,500 barrels daily. Additional charge stock is being obtained from three nearby refineries. Some of the outside naphtha is purchased, and some is being processed for the account of the neighboring refiner and the Platformate returned. Transportation between the various plants is by truck, as the distances are not great. At the present time Old Dutch is running 4,500 barrels of Michigan crude daily, from which it is producing about 600 barrels of heavy naphtha for Platforming, 400 barrels of light, straight-run gasoline and 500 barrels of thermally cracked gasoline. Premium gasoline being produced is a blend of Platformate and thermally cracked gasoline on about a 60-40 ratio plus 3 cc of TEL. The product has a laboratory octane test of 91, but, as mentioned before, the road performance is higher. Old Dutch house brand gasoline now tests 85.5 octane and contains 1½ cc of TEL. The premium grade tests 84 plus.

TYPICAL CHARGE AND PRODUCT ANALYSIS
Old Dutch Refining Company Platforming Operation

	Reactor Charge	Product	Reactor Charge	Product
Gravity °API	56.9	57.6	60.0	62.1
IBP	203	88	176	86
10	220	123	192	129
50	255	240	239	215
90	300	319	302	306
E.P.	333	355	358	364
RVP	0.8	13.6	. . .	10.0
F-1 O.N. Clear	50	86.1	49	81.3
F-1 + 3cc. TEL	68.5	95.8	67.5	93.2
Sulfur	0.0450	0.0020	. . .	. . .

In the preparation of its premium grade before Platforming, Old Dutch had a number of difficulties, one of which was to meet the minimum octane requirement. Another was to pass the 25 mg copper dish gum test. Since blending with Platformate, both troubles have vanished. The Platformate reduces gum-forming tendencies of the thermally cracked gasoline used in motor fuel blends so that the commercial product currently tests below 15 mg. The Platformate appears to be stable in storage over considerable periods without the addition of an inhibitor. It exhibits a good color, permitting dyeing without the complications inherent in a yellow product.

Installation cost of the Old Dutch unit was on the order of $700,000 or roughly $465 per barrel

Performance Data
Old Dutch Platforming Unit

Hours on Catalyst	1681–1701
Average Reactor Pressure, PSIG	730
Average Reactor Temperature, °F.	880

Observed Rates and Yields	B/D	Vol. % of Charge
Reactor Charge	900	100.0
Stabilized Platformate	850	94.4

Calculated 10# RVP Platformate	Vol. % of Charge
Yield	97.3
Outside Butane Required	2.9

Inspection	Reactor Charge	Stabilized Platformate	Calculated 10# RVP Platformate
API	59.5	60.4	61.7
RVP	2.5	8.1	10.0
%Sulfur (Turbidimetric)	0.031	0.003	
Octane Numbers			
F-1 Clear	51.9	79.1	79.9
+ 3 cc TEL	71.4	93.1	93.6
F-2 Clear	48.3	75.8	76.7
+ 3 cc TEL	70.2	87.6	88.3
ASTM Distillation			
IBP	160	103	
10	196	148	
30	217	184	
50	239	214	
70	266	246	
90	304	297	
EP	340	350	

Component Yields		
H_2	(SCF/BBL)	339
C_1	"	66
C_2	"	48
C_3	"	55
iC_4	(VOL. %)	1.3
nC_4	"	5.4
iC_5	"	5.1
nC_5	"	3.3
C_6+		80.2

of charge stock. While this cost does not vary greatly from the cost of a cat cracker of similar charge capacity, the cost per barrel of finished product is, of course, greatly lower. The plant cost is somewhere near the cost of a thermal reformer plus poly unit of comparable capacity.

In the present soft market in the Middle West low octane naphthas such as the Platforming unit is designed to process have been particularly hard to sell, and the price differential below house brand gasoline of standard test has widened. At the moment the published price differential is about three cents per gallon, but the seller of any substantial volume of third-grade gasoline would have to figure on a net about 3.5 to 3.75 cents below house brand, according to John Dalson, Old Dutch sales manager. On the basis of this sort of differential the Muskegon plant is calculated to pay out in considerably less than a year. UOP estimated a maximum cost of 35 cents per barrel of throughput, exclusive of amortization. This figure was based on a catalyst life of six months, and the catalyst was expected to cost 10-12 cents per barrel of charge. A test of the catalyst in the unit after four months of operation shows no loss of activity or volume. The operators now anticipate that it will not be necessary to replace the catalyst oftener than once a year. Perhaps an even longer interval may be possible. If an annual instead of semi-annual catalyst change proves possible, the operating cost will drop some 14 to 17 percent.

In developing the process, UOP engineers considered adding a catalyst regenerating system but abandoned the idea when research showed that changes in the catalyst necessary for successful regeneration would tend to decrease its effectiveness. Pilot plant runs revealed that carbon deposition could be prevented by circulation of proper volumes of hydrogen and controlling other variables. Since other catalyst deterioration was found to be so gradual, it was decided to abandon regeneration and only to process spent catalyst for recovery of platinum at the end of its useful life.

General flow of the Platforming process is indicated in the simplified flow diagram and the photograph of the control house instrument panel which accompany this article. Raw naphtha is induced into a 17-plate prefractionating column on the sixth plate below the center well. Material boiling below 180° F is removed as overhead and mixed with straight-run gasoline produced at the plant by introduction into the preflash column of the crude unit. Bottoms boiling above 390° are withdrawn from the base of the column. By limiting the naphtha charge to a boiling range of about 180 to 390, excess hydrogen formation from light ends and carbon formation from heavy ends are avoided. The unit charge is withdrawn from the center well, passed through a heat exchanger and introduced to the naphtha heater, an Alcorn furnace formerly used in the plant's thermal reforming system. Temperature of the charge is built up to about 550 to 575° in exchange with effluent from the No. 3 reactor. Outlet from the heater passing to the No. 1 reactor is 875 to 925°F.

Heated naphtha stream is mixed with recycle gas before being introduced into the top of the first reactor. Pressure through the reactors is on the order of 700 psig.

Gases and vapors from the first reactor are passed through 21 convection and radiant tubes in one side of an intermediate heater to restore heat lost in the endothermic phase of the reaction.

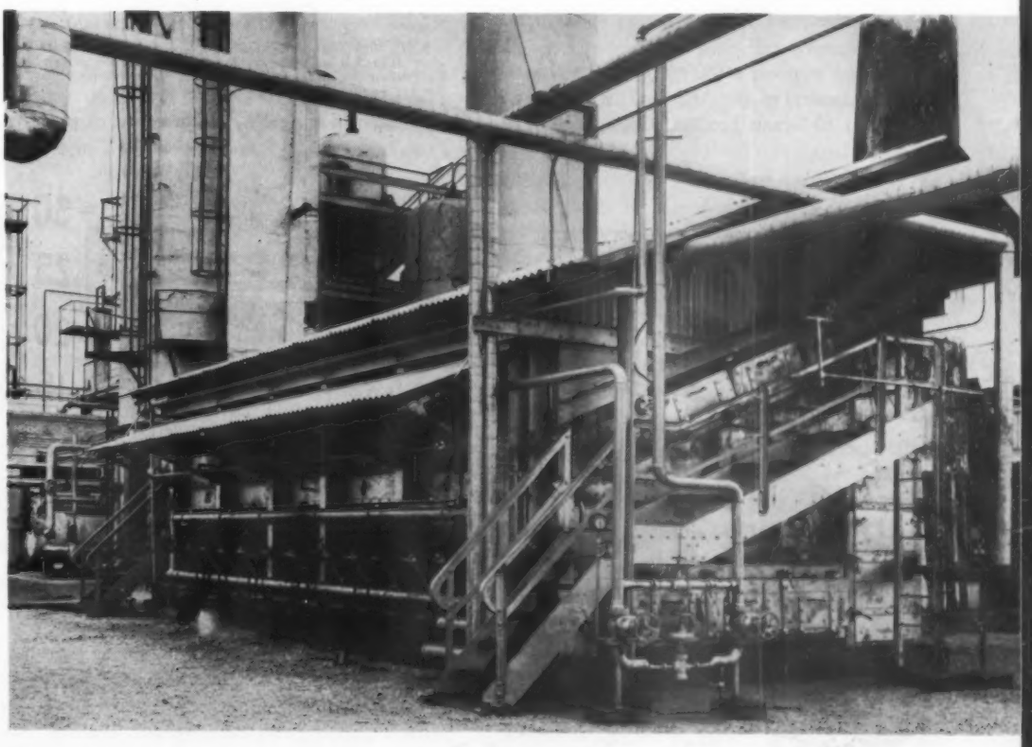
After passing through the No. 2 reactor, the stream reenters the intermediate heater but passes only through six radiant tubes because heat loss in the second reactor is less than in the first.

Effluent from the No. 3 reactor, which is considerably larger than Nos. 1 and 2, passes through a series of exchangers before entering the recycle gas separator, which is a horizontal drum divided by a baffle into two compartments, one of which serves as a suction drum for the recycle gas compressor. During periods of shutdown the separator is used as a storage tank for hydrogen required to start up the unit again. Hydrogen for the initial operation was brought in in cylinders.

Recycle gas from the drum is picked up by one or two compressors, depending on unit throughput, and charged to the recycle gas heater. Each compressor is a six by 13-inch single cylinder-unit driven by a 125-hp electric motor through a gear reducer. The compressor picks up recycle gas at 650 psig and discharges to the gas heater at 850 psig. Each compressor handles up to six million cubic feet per day. Recycle gas is heated from 330 to 850-900°F in the heater before being mixed with the raw naphtha charge.

Hydrocarbon effluent from the recycle gas sepa-

(Please Turn to Page 75)



Naphtha charge furnace used in the Platforming unit was already installed at the Old Dutch plant for use in its thermal reformer.

U. S. LIQUID HYDROCARBON RESERVES

RISE 1.5 BILLION BARRELS IN 1949

PROVED reserves of crude oil and natural gas in the United States increased in 1949 to a new all-time peak, according to a joint study by the American Petroleum Institute and the American Gas Association. Proved reserves of crude oil and natural gas liquids (condensates, natural gasoline and liquefied petroleum gases) were estimated at 28.3 billion barrels at the close of 1949, an increase of 1.5 billion barrels over the preceding year's total of 26.8 billion barrels. Proved reserves of natural gas were estimated at 180 trillion cubic feet. This is an increase of 6.5 trillion cubic feet over 1948's year-end total of 173.8 trillion cubic feet.

Production of crude oil and natural gas liquids in 1949 was estimated at 2,017,347,000 barrels, a drop of 168 million barrels under 1948's record-breaking total of 2,186,197,000 barrels. Production of natural gas was estimated at 6.2 trillion cubic feet, an increase of 237 billion cubic feet over the preceding year.

The proved reserves were estimated by the reserves committees of the API and the AGA at a meeting in Colorado Springs, Colo. The API group accounted for crude oil, while AGA handled the natural gas estimates. Natural gas liquids were estimated by both committees.

A thumbnail picture of the reserves and production picture for 1948 and 1949 follows:

Reserves

(Millions of Barrels)

	Dec. 31 1948	Dec. 31 1949	Increase over 1948
Crude Oil	23,280	24,649	1,369
Natural Gas Liquids	3,541	3,729	188
Total Liquid Hydrocarbons	26,821	28,378	1,557
(Billions of Cubic Feet)			
Natural Gas	173,869	180,381	6,512

Production

(Millions of Barrels)

Crude Oil	2,002	1,819	—184
Natural Gas Liquids	184	198	15
Total Liquid Hydrocarbons	2,186	2,017	—169
(Billions of Cubic Feet)			
Natural Gas	6,008	6,245	237

N.B.: The gas production figures indicated above are net after deducting only the amount of gas returned to reservoirs for cycling and pressure maintenance. They therefore include the gas put into underground storage.

Chairman of the API committee which prepared the oil reserve part of the estimate is Frederic H. Lahee of Sun Oil Co. At the recent district API production division meeting at Dallas, Mr. Lahee presented a paper on the meaning and limitation of reserves reports in which he said that there is widespread misunderstanding because estimated proved reserves are always only a part of the supply.

Mr. Lahee criticized the common practice of using the term "reserves" without defining which of the numerous scopes and meanings of the term is intended. He added: "The habit of dividing the year-end reserves by the production of that year to obtain an idea of the number of years of remaining supply is fallacious and leads to erroneous conclusions."

In its report this year the committee specifically reported that its estimates do not include:

(1) Oil under the unproved portions of partly developed fields.

(2) Oil in untested prospects.

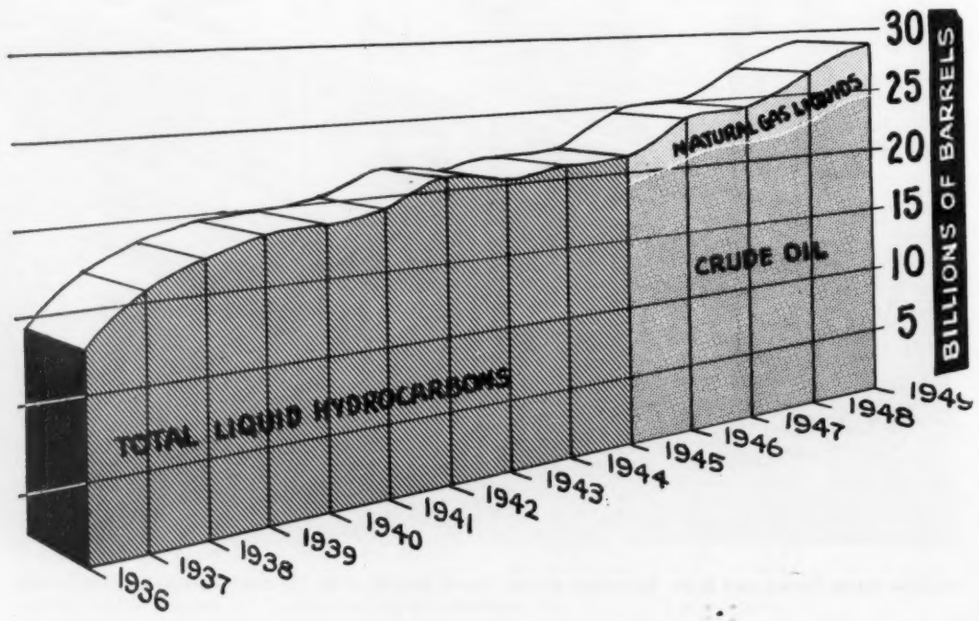
(3) Oil that may be present in unknown prospects in regions believed to be generally favorable.

(4) Oil that may become available by secondary recovery methods from fields where such methods have not yet been applied.

(5) Oil that may become available through chemical processing of natural gas.

(6) Oil that can be made from oil shale, coal or other substitute sources.

The committee especially stressed the fact that its estimates of proved reserves cannot be used in measuring the rate at which these reserves can be produced with or without physical waste. The committee said: "Oil cannot be produced from the permeable rocks in which it occurs at any desired rate, because the flow of oil through the pores of the oil-bearing rocks is definitely controlled by the physical factors of the reservoir. As a matter of fact, today's known oil can be recovered only over a period of many years and at gradually declining annual rates. This has been widely demonstrated by past performance under all kinds of operating conditions. Therefore, only incorrect conclusions as to the life of these reserves can be obtained by dividing these reserves by the current rate of production."



WORKING TOWARD BRITISH-AMERICAN AGREEMENT

By Joseph Huttlinger

Washington

IT is correct to say that the mood of official Washington is one of growing impatience at the apparent lack of progress toward a revision of British government plans for exclusion of American-owned oil from sterling markets. The issue was brought to public notice two months ago by publication of a pro forma letter from the Colonial Secretary's office in London to a colonial official in Africa, suggesting that purchases of petroleum products be shifted from American to British companies and stating that such action would be accepted by the State Department of the United States with no more than a polite expression of regret.

To the many critics of Secretary Acheson's organization within the country, the opening was too tempting to be overlooked, and it was promptly seized upon and exploited. To State Department officials it was extremely irritating to be accused of neglecting the defense of their country's interest, regardless of the truth or falsity of the charge itself. They were practically forced to display a more vigorous attitude, which took the form of renewed representations to the British government, a conference between members of the State Department and officials of the American oil companies directly affected by Britain's restrictions, the proposal that officers of these companies state their position to British officials then in Washington, a further conference of American interests and the preparation by the State Department of a paper answering the so-called "incentive scheme" put forward by the British Ministry of Fuel and Power as affording a means by which Americans could overcome some of the obstacles to the maintenance of their international trade. All this paved the way for another inter-government talk late in March. There has been also a suggestion from the British that American company representatives enter into direct discussions with cabinet officers in London.

While this question has had a place in the public forum since early in the year, it has figured in negotiations regarding oil for a still longer period. Meanwhile the British program is being carried out along the lines originally set, and American companies are feeling its effects in their international markets.

To a member of Congress the obvious response to any action that injuriously affects American interests is legislative action, and there have been various proposals for such action in the present situation. Representative Monroney of Oklahoma proposed an amendment to the United States tariff law permitting the Tariff Commission to retaliate in kind against any foreign discriminatory practice. More directly applicable is the recommendation of Senator Connally of Texas, chairman of the Foreign Relations Committee of the Senate. He would amend the act authorizing assistance to western European countries through the Economics Cooperation Administration to deny aid to any country that "discriminates" against American company oil. All aid would be contingent upon an additional condition, namely the refusal of European countries to engage in "restrictive trade practices." This could be interpreted as barring resort to quotas or other forms of direct exclusion and as requiring the admission of American company oil to common markets on equal competitive terms.

As a matter of fact ECA has the right to extend its financial assistance in the areas and in the forms which it deems most effective in aiding economic recovery in the nations participating in the European Recovery Program. The only change that would result from adoption of the Connally proposal would be to place a mandatory restriction on its operations under specified conditions.

Much has been made of the statement of Paul G. Hoffman, chairman of ECA, before a subcommittee of the House Commerce Committee, in which he said:

"We are withholding further financing of British company projects anywhere in the world pending the hoped-for successful outcome of these negotiations.

"We have not felt it necessary to withdraw the approval of the two refineries in the United Kingdom which we have financed or the two on the Continent in which British companies have an interest, which are also ECA financed. We are still hopeful that a satisfactory outcome will be obtained from these negotiations and that some kind of normal trade relations can be reintroduced into the international oil trade so that commercial considerations can once more play a major part in determining the pattern and rate of expansion of the overseas petroleum industry."

This action of ECA, however, is simply in line with its policy of opposing unnecessary duplication of facilities which, in its own phrase, "might result in a new pattern of protected trade presenting additional obstacles to a return to convertibility of sterling and liberalization of trade." There has been a difference of opinion between ECA and the European advisory committee OEEC as to the rate of probable increase in petroleum consumption by the ERP countries. Representatives of these countries have held to their early estimates of a nine to ten percent growth in consumption each year up to 1953, while ECA has taken a more conservative view. In the present discussion over the exclusion of American-owned oil from international markets, however, ECA has confined itself to acting as a consultative aid to the Senate Department which is directing the negotiations.

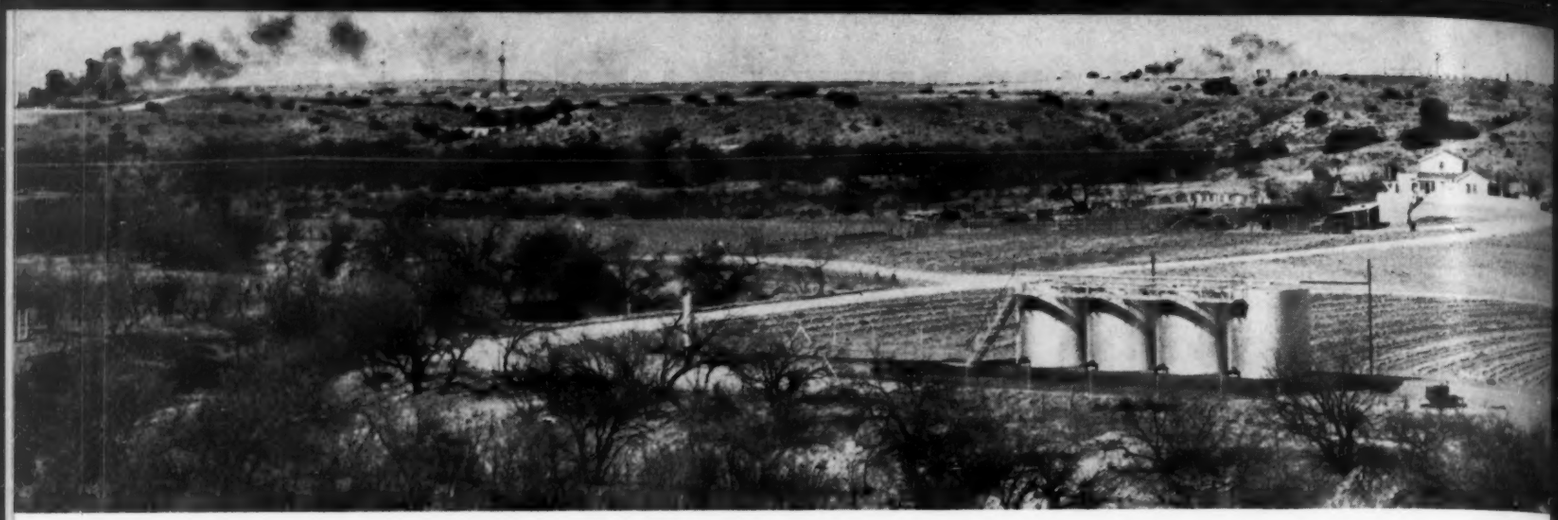
On its face this question of exclusion appears to present no insoluble problem. British authorities have stated that the measures they have taken are only temporary, and they insist that their sole purpose is to reduce the amount of dollars that Britain is required to pay out to obtain its needed supplies of petroleum products. They point out that certain dollar costs are involved in all oil regardless of its source but assert that fewer dollars are required for oil produced by British companies than for that produced under American ownership. If an American-owned company can show that it can reduce the dollar cost of its oil to the same level as that of British companies, they state that they are willing to admit it to markets which they dominate through control of sterling exchange, but they continue to express their disbelief that this can be done.

On this point the American companies operating abroad declare that, if permitted to operate on equal terms, they can bring the dollar costs of their oil to a parity with that of British-owned oil in any part of the world. They cite Venezuela as a clear example of a country where both British and American companies are producing oil under exactly the same conditions and where obligations to the Venezuelan government and other expenses must be settled in hard currency. Here, it is admitted, there can be no appreciable difference in dollar costs. Even in the Persian Gulf area and the Far East the Americans maintain that under equal terms they can produce their oil with no heavier dollar costs than those of British-controlled companies.

It is to this phase of the matter that the State Department of the United States is reported to be directing its latest communication to the British government. It finds the "incentive plan" proposed for American companies by the British Ministry of Fuel and Power unsatisfactory in several respects.

So far as revealed here, no reply has been received from British official quarters to the proposals advanced by American companies. Some British oil men, speaking as individuals since they have no part in the negotiations, have expressed the opinion that, if the question could be left to direct discussion between the Ministry of Fuel and Power with representatives of the American companies, a solution could be found with no great difficulty. The obstacle, they feel, is the British Treasury, directed by Sir Stafford Cripps, which, having taken its stand, is opposed to change. If negotiations are to be conducted at top levels officially, they are likely to be protracted.

Meanwhile the British program for replacement of American-owned oil from markets where their exchange control extends is in operation and is increasingly affecting the position of American-owned oil in international markets to an extent estimated at 150,000 barrels or more daily. That accounts for the rising impatience observable here.



THE DIAMOND M REEF OF SCURRY COUNTY,

By E. D. Klinger*

THE Diamond M field of southwestern Scurry County lies in the southeastern part of the Great Plains of Texas. Anyone who has travelled through this part of the midcontinent is familiar with the monotonous character of the landscape. Even the presence of the Colorado River a few miles to the southwest of the producing area provides little scenic beauty.

Discovery of an enormous oil pool in Scurry County provides a fitting answer to the individuals who maintain that all substantial oil reserves in this country have been discovered. It is a development that provides a few surprises to that segment of the oil industry engaged in exploring for oil. Individuals conducting this search realize full well that many of those areas where little development has taken place probably harbor oil pools under conditions that are entirely unknown. Until all such potential areas have been thoroughly explored, the ultimate oil reserve of this country cannot be determined.

It is interesting to note that the Diamond M field lies only 14 miles north of the Westbrook field of Mitchell County, where the first production in the Permian Basin was developed in February 1920. Strangely enough, the early efforts to discover other producing areas in the region failed to uncover the reef deposits of Scurry County, and the numerous fields of West Texas were developed before the attention of the oil industry returned to Scurry.

The vast area of potential oil-producing territory, lying between the Permian Basin and the Bend Arch of west-central Texas, has long interested the geological departments of the various companies operating in western Texas. This area was largely dormant during the development of the pre-Permian production to the west, although it was realized that potential producing horizons existed and would be productive if they were located in the proper structural traps.

These conditions were responsible for the decision by the Lion Oil Company to devote part of its exploration budget to this area. The available subsurface data was studied by F. H. McGuigan, division geologist of the Lion Oil Company, in Midland, Texas, who mapped a structure on the shallow beds north of the Sharon Ridge field. A block of leases was secured, and the No. 1 McLaughlin was begun in April 1945 to explore Permian beds producing in the Sharon Ridge and Westbrook fields to the south. The well failed to find production and was temporarily abandoned at 3,724 feet. This well confirmed the structure on the shallow beds but was not carried deeper because of lack of information concerning structure on the pre-Permian.

The No. 1 Strom was drilled in August 1946 to test the possibilities of developing shallow production on the flanks of the structure but was dry and abandoned at 2,903 feet.

At that time the presence of reef production in the Pennsylvanian in Scurry County was not known, but the possibilities of developing pre-Permian production in this area were considered good and were responsible for a decision to drill a deep test on the Diamond M block. A seismic survey was made in the fall of 1946 in order to map the pre-Permian beds for the purpose of properly locating the deep test. A detailed study of the seismic results led to the conclusion that reefing was very likely present in the Pennsylvanian. This conclusion was supported by completion of the Sun No. 1 Schattel, several miles to the east of the Diamond M block in August 1948. It was also determined that the structure on the deep beds conformed with that on the shallow beds so that the location for the deep test was made as a diagonal offset to the first well drilled on this block.

The discovery well, Lion Oil Company No. 2 McLaughlin, located in the southeast corner of section 197, block 97, H & T C Survey, Scurry County, Texas, was spudded on November 2, 1948. Canyon Reef limestone was encountered at a depth of 6,562 feet and the well drilled to 6,580 feet with the cuttings showing very good porosity and saturation. A fifty-minute drill-stem test was made with gas reaching the surface in six minutes, and recovering 790 feet of clean oil and 510 feet of heavily oil-saturated and gas-cut mud. A second drill-stem test was made from 6,583 to 6,615 feet for 70 minutes. Gas reached the surface in five minutes and oil in 58 minutes. At that time nothing was known concerning the water level in the field, and the well was completed at that depth. It was perforated from 6,592 to 6,614 feet and flowed at the rate of 150 barrels per hour after washing with acid.

Development of the field was reasonably rapid, being accelerated in the latter part of 1949 when 17 rigs were being run for the Lion Oil Company. At the present time 86 producers have been completed from the Canyon Reef in the Diamond M field.

The early development took place in the eastern part of the area on which there was most information. However, in September 1949 the shallow dry hole formerly drilled in the western part of the Lion Company's block was deepened and made a very good producer from the Reef lime, encountered approximately 160 feet above the currently accepted water table. Because of this well, the development of the western part of the field will be accelerated.

* Chief geologist, Lion Oil Company.

North Synder Field, Scurry County, Texas, showing Cities Service Jolly lease, east battery. Photo courtesy Cities Service Oil Co.

TEXAS

Lion McLaughlin No. 2, discovery well of Diamond M. From painting by Claude Montgomery. Courtesy of Exploration Drilling Co.

At the present time no dry holes have been drilled which limit the Diamond M producing area, and the outlines of the field cannot now be fixed.

Short-term leases resulted in the location of the Humble No. 1 Bishop, three miles south of the discovery well in the Diamond M field, in the early part of 1949. Production in the Canyon Reef was encountered in this well, resulting in the discovery of the Sharon Ridge (canyon) field in March of that year. The development of this producing area progressed to the south and west, and it cannot be determined at present whether it is a part of the Diamond M field.

The upper part of the stratigraphic section of the Diamond M field consists of Triassic red beds. These beds overlie Permian formations. The first Permian formation is the anhydrite occurring at an average depth of 700 feet. This horizon is the top of the salt and red bed section which has decreased from a thick series in the Midland Basin to an average thickness of 950 feet in this area.

The San Andres formation, containing the first dolomite in the section, occurs at an average depth of 1,700 feet. It is the first horizon considered sufficiently reliable to map. A prominent member of the group in this part of west Texas is the Glorietta-San Angelo sandstone found at an average depth of 2,400 feet. The top of this sand lies approximately 100 feet above the top of the Clearfork group, which is largely dolomite in this area. It overlies the Wolfcamp dolomite, encountered at an average depth of 5,000 feet. The lowermost Permian beds in the area comprise the Black Shale, encountered at an average depth of 5,200 feet.

The producing horizons of the shallow Sharon Ridge field, which lies immediately south of the Sharon Ridge Canyon field, are found in the San Andres and Clearfork formations. These shallow producing horizons were the objectives of the early wildcatting activities on the Diamond M block. This early wildcatting did not result in the discovery of production from the shallow beds, but since that time the Hiawatha No. 7 Wilson was completed as a producer in the Clearfork dolomite.

The top of the Pennsylvanian in the Diamond M area, found at a depth of 6,569 feet in the discovery well, is the top of the producing reef. This has been identified by faunal evidence as Canyon in age. The younger Cisco formation, which is generally found in the stratigraphic sequence of the Pennsylvanian in this part of Texas, is missing in the Diamond M area, although remnants of it have been identified in several wells in western Scurry County.

The Canyon Limestone is typical reef material consisting largely of crystalline dolomitic limestone containing many vugs. Cores have been recovered in which these holes are more than an inch in diameter. Fracturing, common to reef limestones, has also been observed. The porosity is rather erratic although present data indicates that porous beds can be zoned. However, very little is known about the reef since only one well has penetrated it as much as 300 feet.

Nothing is known concerning the formations below the Canyon Reef in the Diamond M field. Dry holes in western Scurry County indicate that the top of the Strawn would be encountered at approximately 7,100 feet in the discovery well. Commercial oil has been developed in several areas in Strawn limestones, while other wells have had very encouraging showings. For this reason the possibilities for developing Strawn production in the Diamond M field are considered good. Other possible producing horizons are the Mississippian limestones, which should be encountered at approximately 7,650 feet in the discovery well, and in the Ellenburger Dolomite, which should be encountered at approximately 7,925 feet in the discovery well.

Any discussion of structural conditions on the Diamond M area must take into account the fact that the "structure" on the Canyon Reef producing horizon is not an anticlinal fold. The apparent similarity to a structural fold is due to the manner in which the reef-building organisms grew and deposited their skeletal remains in a mass of reef limestone. There are many facts about this reef mass that will not be known until more information about it can be determined from additional wells. At present it appears that it may extend from the Coguell area of Kent County to the Durham area of eastern Borden County and beyond in each direction for an unknown distance. It further appears likely that the reef mass will be continuous throughout this area, although this does not mean, necessarily, that production will be continuous.

Very little is known concerning the structural attitude of the base of this reef mass. It appears likely, however, that it is not folded and that the reef-building organisms started the growth of the limestone mass on a gently shelving sea floor. The growth of the reef-building organisms and the resultant development of the limestone mass was controlled by local variations in depth of water, temperature of water and the position of food-bearing currents. At some places all of these conditions were favorable, and the limestone mass grew rapidly, while adjacent to it unfavorable conditions existed and the limestone mass grew slowly. Consequently today we have as much as 140 feet difference in elevation of the reef between offsets one-quarter mile apart. Furthermore, it is not possible to predict with any accuracy the datum at which any well will encounter the reef, even though it is not more than one-quarter mile distant from a producing well.

The Permian beds overlying the Canyon Reef are folded into structure that conforms reasonably well with the attitude of the reef surface. This folding is due to the draping of these sediments over the lime mass. This draping is caused by the deposition of material surrounding this mass which can be compacted far more than the mass itself.

The similarity of the structure on the San Andres to the surface of the Canyon lime is striking, as can be observed from the maps contoured on these horizons.

The performance of the discovery well which flowed over 150 barrels per hour from only part of the producing horizon shows that large wells can be completed in the Diamond M field. Under proration, however, there is no necessity for this, since the allowable for January 1950 was 220 barrels for 17 days, or a daily average of approximately 120 barrels per well. The oil is of very good quality, being sweet and having an average gravity of 43 degrees. In this respect it is similar to oil found in other reefs of Pennsylvanian age and differs from the oil found in reefs of Permian age in the West Texas basin.

Scurry Co. Wells As of March 2

Field	*Active*	*Completed*
Sharon Ridge Canyon	13	39
Diamond M	30	95
Kelley	72	144
North Snyder	56	259
Schattel	0	1
Wildcats	11	—
Totals	182	541

Any consideration of the oil reserves in this field immediately brings into focus all the difficulties inherent in estimating the amount of oil in a limestone reservoir with non-homogeneous porosity. This is particularly true when we are dealing with porosity developed in a lime mass deposited by reef-building organisms where dense lime is adjacent to vugs of considerable size and where the mass has been fractured during compaction by overlying sediments.

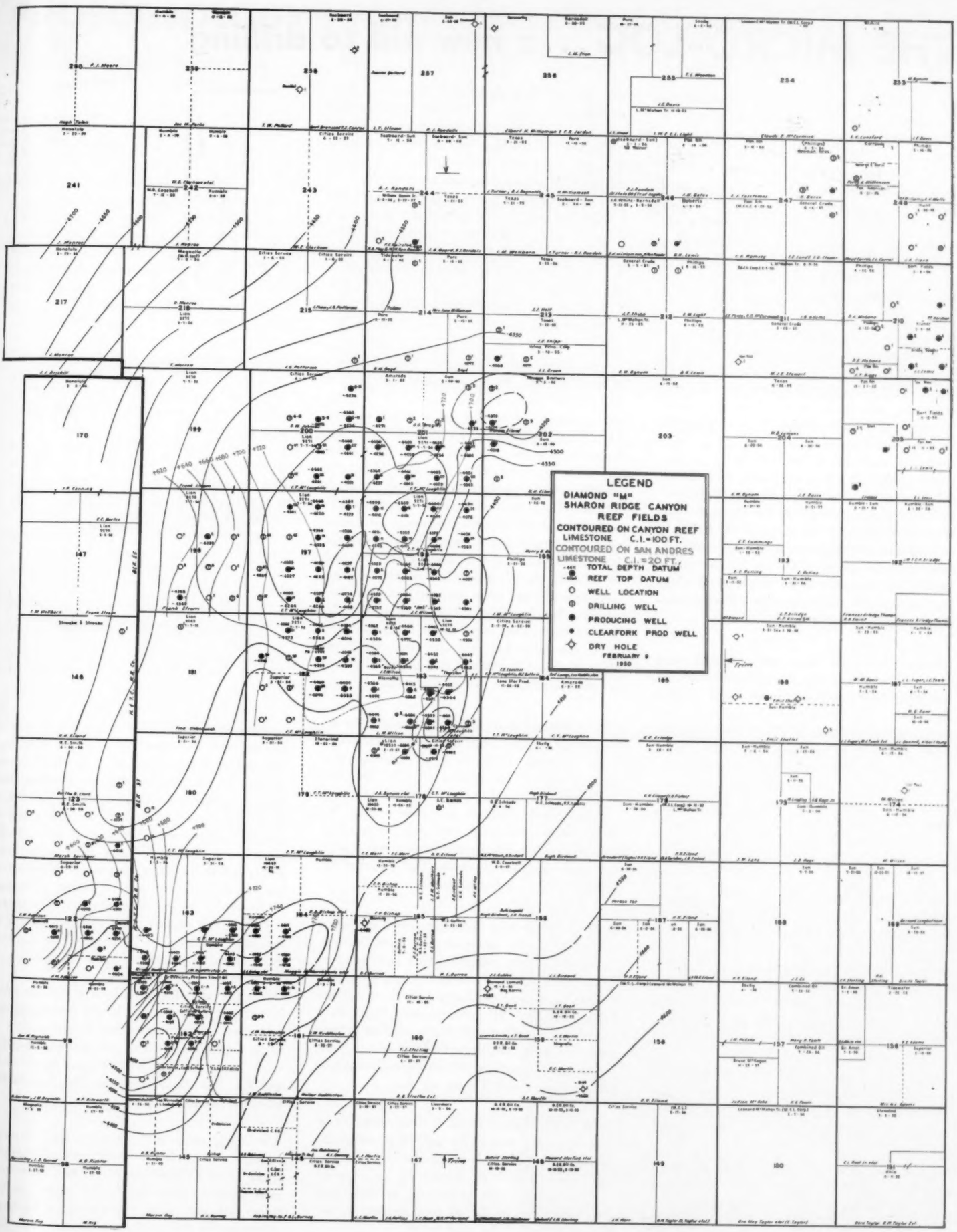
In estimating reserves in a reservoir of this type, there is a tendency to place them too low, particularly if undue consideration is given available core analyses information. Generally core recovery will be greater in the denser parts of the lime. In addition, core analysis does not take into account the vugs and fractures that are present. Consequently it is believed that any estimate of oil reserves predicated on such scientific data will be low and misleading.

The difficulty of estimating reserves in this field is increased by uncertainties concerning the position of the water table of both the Diamond M and the Sharon Ridge Canyon fields. In the early stages of development oil and water were encountered in a well in the Sharon Ridge Canyon field on a drill-stem test between a datum of 4,422 feet and 4,449 feet. It was assumed for some time that the water level under both the Sharon Ridge Canyon and the Diamond M fields was at a datum of approximately 4,434 feet. No additional data concerning the position of water in the Sharon Ridge Canyon field has been secured through additional development.

Information concerning the position of the water table under the Diamond M field was first secured in the Lion Oil Company's No. 23 McLaughlin in the northeast part of the field. On a drill-stem test from 4,493 feet to 4,503 feet subsea, 1,840 feet of oil and 276 feet of salt water was recovered. Additional information concerning the water table was secured from the Lion Oil Company's No. 2 Strom in the western part of this field. On a drill-stem test from a datum of 4,484 feet to 4,504 feet subsea, this well flowed oil at an estimated rate of 30 barrels per hour for 30 minutes, but recovered over 1,000 feet of salt water in the drill stem. These tests indicate that the water table under the Diamond M field lies at an approximate subsea datum of 4,500 feet.

Sharon Ridge Field. Courtesy Cities Service Oil Co.

Oil and farming go hand in hand. From a painting by Claude Montgomery.



Lion Oil Co.'s map of Diamond M area contoured on Canyon Reef Limestone. Color overlay shows contour on San Andres Limestone.

THE MICRO-LOG . . . a new aid to drilling

IT IS well known that petroleum occurs only in permeable rocks, or formations that have pores or open spaces in which oil or gas may accumulate. In the drilling of oil wells, it is generally found that permeable beds or strata alternate with impermeable beds. The latter are of small interest to the prospector for oil. On the other hand, it is important to learn the location and thickness of the porous beds of the geological column through which the drill has passed in order that they may be carefully scrutinized for the possible presence of oil.

A principle for distinguishing permeable from impermeable beds penetrated by the drill has long been known. This principle depends on the fact that impermeable beds have high electrical resistance, whereas permeable beds have lower resistance. On this principle is based the well known practice of "electrical logging," in which electrodes suspended on insulated wires are lowered into the hole; these electrodes, connected to galvanometers at the surface, register differences in electrical conductivity as the electrodes pass the exposed faces of the strata in the hole. In conventional electrical logging what is called the spontaneous potential (SP) log is used to delineate the permeable beds, and the resistivity logs are used primarily to provide indications concerning the fluid content of the beds.

However, when the formations are much more resistive than the mud fluid which is always present in newly-drilled holes, for example, in limestone fields, the SP currents are short-circuited by the more conductive mud column, with the result that the SP log is quite rounded and, therefore, more or less indefinite regarding the location of boundaries between the various formations. In that case the usual SP log generally gives only the approximate positions of the permeable beds, but it cannot be used for an accurate definition of the permeable beds.

For the cases where the SP log alone does not give a satisfactory answer to the problem, an apparatus and procedure called "micro-logging" has been developed by H. G. Doll of the Schlumberger Well Surveying Corporation and described by him to the February 1949 meeting of the Petroleum Branch of the American Institute of Mining and Metallurgical engineers. This new development has found its first field of application in limestone areas where its usefulness is most obvious; it is also of importance in sand and shale formations for a more precise determination of boundaries between successive beds, and evaluation of the "sand layer count."

A micro-log is defined as a resistivity log recorded with electrodes spaced at short distances from each other in an insulating rubber pad, which is pressed against the wall of the hole by a spring. As may be seen from Figure 1, the electrode system contains three points: A, an electrode where the electric current enters; and an electrode M_1 through which it leaves to register on the galvanometer G (Figure 2); and another electrode M_2 somewhat farther from A and through which the same current reaches a galvanometer G_2. Galvanometer G_3 is for reference purposes. The two electrodes measure the average resistance of the ground under the pad and whether or not the resistivity varies with depth from the pad. The three electrodes are placed on a vertical line in the middle of the pad with a spacing of one inch between the successive pads. The difference or "departure" of the galvanometer readings from electrodes M_1 and M_2 is the principal diagnostic means.

In the identification of highly resistive impervious formations, the diagnostic is based on the fact that all micro-resistivities are 20 or 30 times the average resistivity of the mud and are not likely to be recorded for a permeable formation. Impervious bends of low resistivity have about five times the resistivity of the mud. When the resistivity of the impervious bed is not too much different from the resistivity of the mud, there is practically no departure between the micro-resistivity curves, but when the resistivity of the impervious bed is appreciably higher than that of the mud, there is generally a substantial negative departure which is characteristic of an impervious bed in this case. A large positive departure between the micro-curves is characteristic of a permeable bed, provided that the resistivity measured by the one-inch normal electrode is less than 30 times that of the mud.

Out of such relations and considerations, the experienced operator can distinguish between a variety of cases. There are certain cases in which the departure is not definite enough (less than 20 percent) for the micro-log to determine whether the formation is permeable or not. To resolve such ambiguities note may be taken of the trend of the SP curve; if that trend is positive, then the bed is impervious and the micro-log will give its exact boundaries.

A field example of a micro-log, shown in Figure 3, illustrates the sequences met with in non-consolidated sands and shales, such as those commonly encountered in the Gulf Coast or in analogous geological provinces. In these regions the conventional SP and resistivity logs differentiate very well the different sections where sands or shales are respectively dominant, but they are not capable of delineating each separate sand or shale streak if these are thin.

As shown in Figure 3 and in other instances, a very detailed record of the individual permeable and impervious beds is obtained from a micro-log. This result is of interest for an accurate determination of the proportion of shale and shaly sands, or, in the oil field vernacular, for the evaluation of the sand count.

Very clear results have been obtained in sequences of shales and limestones where most of the compact beds give rise to micro-resistivities that are definitely higher than 30 times the resistivity of the mud, so that the discrimination between permeable and impermeable formations is particularly easy, as proved by comparison of the permeability record with core analysis. In complex sequences of sands, sandstones, limestones and shales, sharp depressions in the micro-log reveal almost certain indications of caving, confirmed by the section gauge log. The micro-log has given important information in a thick limestone formation (Ellenburger) of compact and fissured zones with vugular porosity.

While the micro-log has proved of definite value in certain typical cases, it is still undergoing development. One improvement that is in sight is an arrangement whereby the specific resistivity of the zone that has been invaded by the mud and the thickness of the mud cake can be determined quantitatively.

The conclusion is that the micro-log is already an important supplement to the conventional electrical log and should contribute to a better and more accurate determination of boundaries between beds and layers, particularly in limestone territories; in this work it can render important service in sand and shale formations and appreciably increase the accuracy of the sand count.

← Figure 1

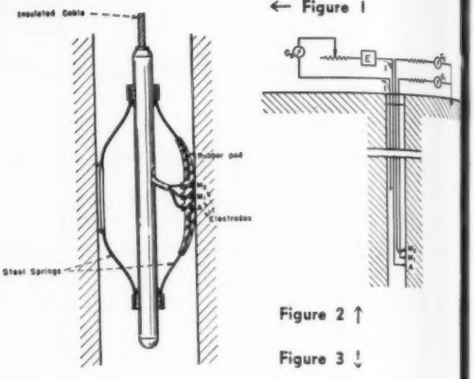
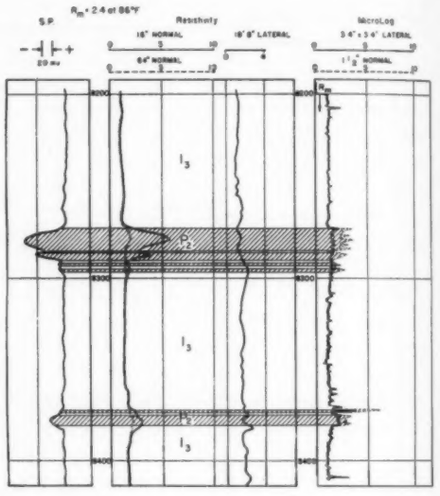


Figure 2 ↑

Figure 3 ↓



PHOTOGEOLOGY'S PLACE IN PETROLEUM EXPLORATION

By Laurence Brundall
and A. R. Wasem

Part 2

IN CASE no mosaic of a controlled or semi-controlled nature is available as a compilation medium, an alternative procedure has been evolved which results in the production of a map whose planimetric accuracy is less than that obtained by using mosaics having some control, but which is still considered to be within the limits demanded of reconnaissance mapping. The procedure in this case is to lay alternate contact prints, with edge detail matched very carefully, into a stapled mosaic.

Figure 8 shows four contact prints covering a portion of the Wilson Creek dome, Moffat County, Colorado, laid down in a stapled index of the type described above. Ordinarily in the course of mapping a project area, the stapled mosaics covering the area are prepared in several sheets with a single mosaic generally covering an area 4 x 6 feet or approximately 380 square miles, if the photographic scale is 1/20,000, providing, of course, that no complication such as a radical change in scale between flight strips is encountered. In such a case, the stapled mosaics are broken between the flight strips.

All known control points which can be located on the photographs by office inspection are indicated on the photographs and on the base map. In the case of the Wilson Creek area, a topographic map of the U. S. Geological Survey provides adequate control through road intersections, stream junctions and peaks. Sheets of transparent acetate are placed over the stapled index mosaics and all the pertinent geologic, geographic and cultural information is then traced onto the acetate sheet. Figure 9 shows a print made from the acetate overlay of the stapled index mosaic. The acetate sheets are photographically reduced to the scale of the base map using the control points to calculate a reduction factor. The information on the reduced sheet is then transferred to the base map, using the projection machine

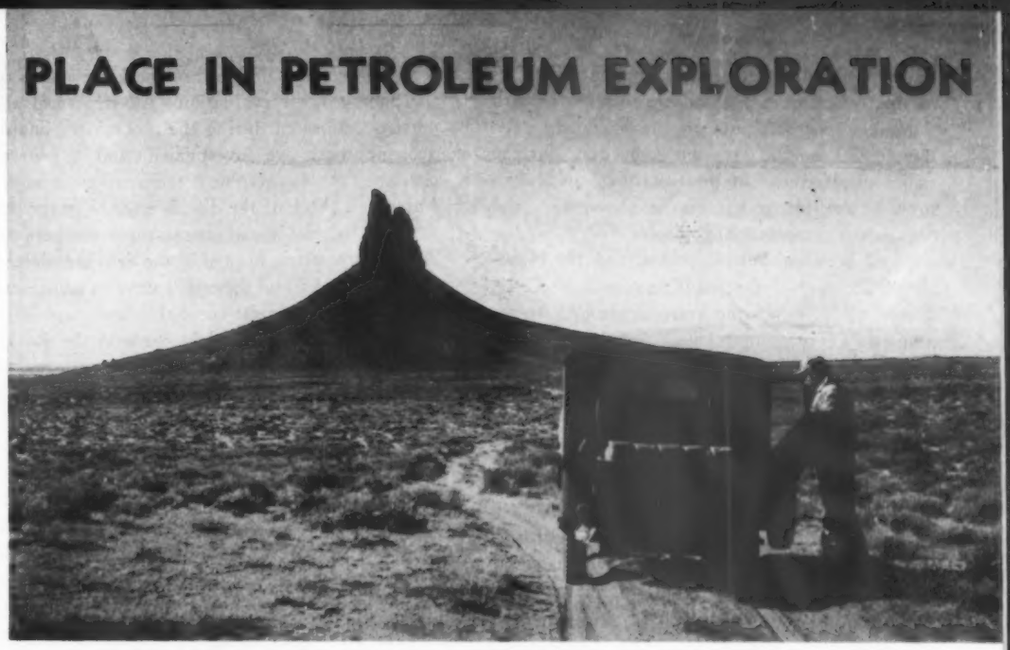


Figure 12: Typical field check in Rocky Mountain area. The tall rock spire is "Boar's Tusk," a volcanic plug in Sweetwater County, Wyo. Such prominent landmarks are valuable as location aids in areas of few roads. Four wheel drive vehicles are a necessity in most Rocky Mountain areas.

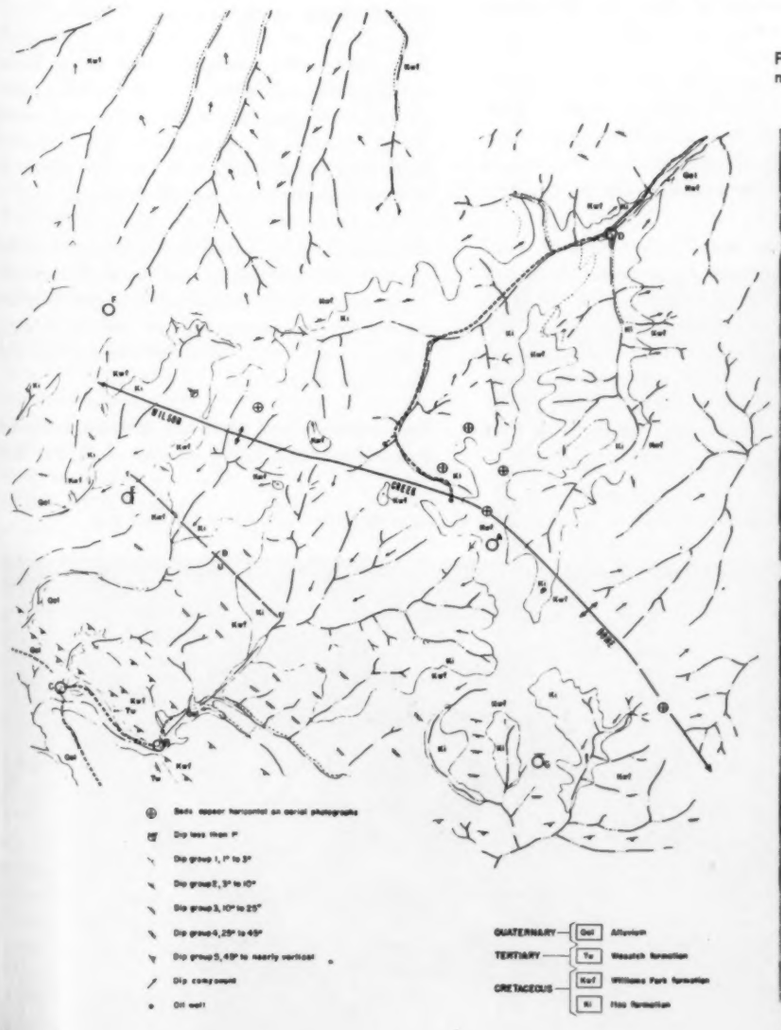


Figure 9: Overland tracing of stapled mosaic, Wilson Creek Dome Area, Moffat County, Colo.

Figure 8: Stapled mosaic of Wilson Creek Dome, Moffat County, Colo.

which will adjust any group of control points on the reduced acetate sheet into coincidence with the same control points on the base map. Although this method does not compensate for the radial displacement of positive topographic features or for tip or tilt in the photograph, the planimetric error in the stapled index is distributed between control points, and the planimetric accuracy of the resulting map is also considered to be within the limits demanded by reconnaissance mapping. Checking of the planimetric accuracy during the field check has shown that found section corners are almost invariably within 500 feet of their true geographic position.

A third method of map compilation is the radial plot method. The technical details of this method are well known and will not be further discussed in this paper. The method is costly in that it is time-consuming and is generally used only where an extremely accurate planimetric map is desired for leasing or development purposes. Control for the radial plot is obtained by identifying section corners and other known geographic points during the office inspection of the photographs. If necessary, field parties are sent to the area to locate and identify additional section corners and mark their proper position on the aerial photographs. With control spaced as much as 10 miles apart, a radial plot map covering 6,000 square miles has been constructed in which the mapped positions of all found corners were found to be within 50 feet of their true position. Figure 10 shows the template lay-down of a portion of this radial plot work, and Figure 11 shows a universal sketchmaster being used to transfer all geologic, geographic and cultural information to the base map.

A fourth variant in the mapping procedure has been developed in areas where excellent topographic or planimetric maps are available. In this case geologic information is transferred directly to the topographic sheet or planimetric map by means of a sketchmaster using the road and drainage patterns of the base sheets as control for adjustment of the instrument.

Field Check: Upon completion of this preliminary photogeologic work and the planimetric mapping in an area, the project is ready for a review in order to determine field check procedure. The field check is designed to check the results of the photogeologic evaluation. All structural anomalies delineated during the preliminary photogeologic work are investigated, and a general check of the stratigraphic determinations is made. Further, a check of the dips is made to gauge the accuracy of the visual stereoscopic estimations. All section corners located in the field are plotted on photographs, and these will serve as additional control in the preparation of the final map. Figure 12 shows a typical field check in the Rocky Mountain area. An average domestic area of 2,000 square miles can usually be checked in a week to ten days' field time.

It is the policy of Geophoto Services to field check all projects wherever possible. This has proved to be an extremely valuable aid in the final assessment of the value of any area as a possible producer of oil and gas as well as to serve as a consistent check and refresher in the procedures of mapping surface geology by photogeologic evaluation methods.

Structural Contour Maps: In some areas structural contour maps are prepared, either because the inclination of the strata is so gentle (regional dips of 30 to 90 feet per mile) that a structural interpretation cannot be made by stereoscopic examination of the aerial photographs alone, or because structural anomalies have been discovered during a reconnaissance evaluation on which it is desirable to have quantitative structural control. The following procedures deal primarily with structural contour maps in low-dip country where rock exposures are good and where key units can be traced for many miles.

Figure 13 shows exposures of Cretaceous limestones on the Edwards Plateau region, Irion County, Texas. Such striking bedding as is exhibited here can be traced continually for tens of miles throughout the Edwards Plateau country.

The Pennsylvanian and Permian rocks of west-central and north-central Texas can also be traced continually over long distances and are well adapted to surface structural contouring. In making a photogeologic evaluation of such areas the most persistent beds are traced on the photographs; then a planimetric map is prepared by any of the methods described above. This map shows the areal geology of the area as well as all pertinent geographic and cultural information.

Upon completion of the planimetric mapping of the area, the project is ready for vertical control work which will permit the preparation of a surface structural contour map. A number of methods can be used to obtain elevations on the key beds which have been traced on the aerial photographs.

Figure 14 shows the final map covering a small portion of Young County, Texas. In this instance elevations on the key horizons and the stratigraphic intervals to the contour datum were determined by interpolation from a topographic sheet.

The final decision as to which vertical control method should be used is entirely dependent upon the problems encountered in each individual project area. If, for example, a company can furnish sufficient elevation control in the area, it is feasible to use a height-finding instrument for the elevation control work. A third method is to obtain the elevation control by a combination of plane table and altimeter traverses in the field.

Figure 15 is an example of structural contouring using elevations obtained by plane table survey in the field. Elevation determinations in small areas can usually be done cheaper by on-the-ground surveying since, in most cases, even with the use of a height-finding instrument, it would be necessary to send a survey party into the area to provide elevation control points for tip and tilt correction of the photographs to be used in the photogrammetric process.

The plane table traverse of the Johns Valley anticline was completed in only five days, since an aerial geology map of the structure showing the delineation of all key beds had previously been constructed and it was a simple matter to determine elevations at pre-selected locations.

There are numerous instruments designed for the determination of height from aerial photographs. They range from the simple and not very accurate stereocomparagraph to the exceedingly complex and accurate Zeis Stereoplanigraph and the Wilde Autograph.

Very expensive and ultra-precise instruments are designed for topographic contour work, but they

Figure 10: Radial plot template network.

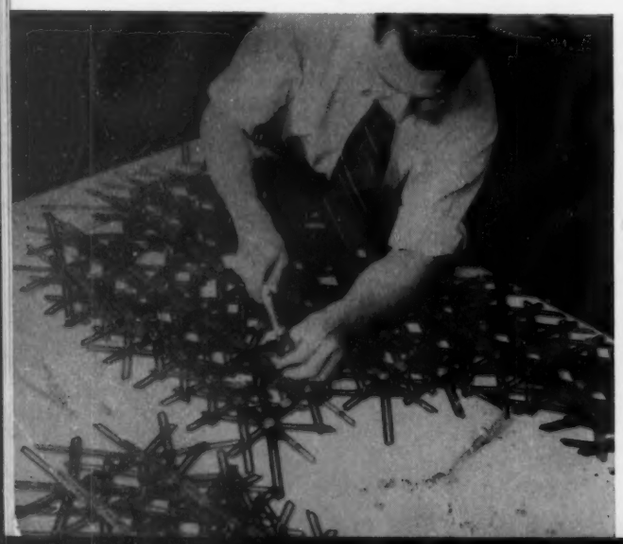


Figure 11: Universal sketchmaster in use to transfer data from contact print to a base map.

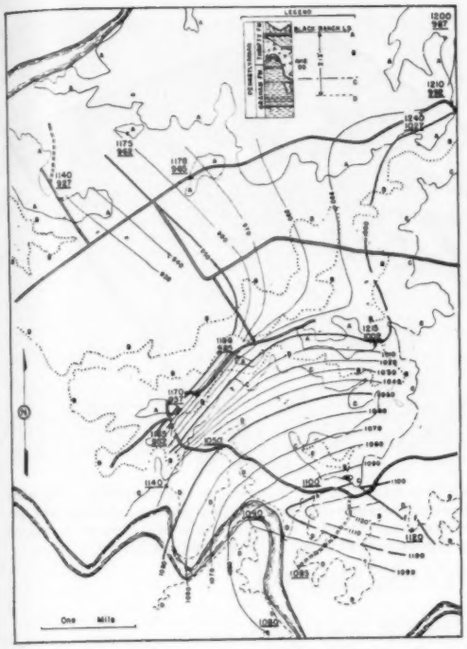


Figure 14: Areal Geology and Structural Contour Map of an area in Young County, Tex. Contoured on Bed "D"; Interval 10 feet.

are not too well adapted for the determination of spot elevations to be used in the construction of structural contour maps. For this type of work, instruments in the medium range of price, accuracy and operating speed are best suited to the needs of the geologist. Such instruments are the K. E. K. plotter (Figure 16), Wernstedt-Mahan plotter and Kelsh plotter. The Multiplex Projector (Figure 17) is also an excellent instrument for spot elevation determination, although more expensive than the KEK, Wernstedt-Mahan and Kelsh instruments.

No matter which method of elevation determination is used, the total cost of preparing structural contour maps when the base map construction and aerial geology delineation is accomplished by photogeologic methods is much less than by conventional surface mapping methods.

Completion Procedure: Reference to the operations flow chart will indicate that the project has reached the final stages of completion. After any necessary revisions and corrections have been made following the field check or vertical control work, a final map is prepared and the report written. The final map and report are subjected to a careful review in a seminar type discussion during which the supervising photogeologist must demonstrate the basis for his interpretations and justify his conclusions with respect to the structure and petroliferous possibilities of the area under consideration. This review is regarded as the last step in the photogeologic evaluation of any area.

Foreign Evaluation: Because of the relative high cost of new, full vertical coverage in foreign areas, a compromise can be made by using cheaper trimetrogon photography taken during the war years by the U. S. Air Force. This photography is available for most of the possible petroliferous areas of the world which were not in enemy territory during the recent war. Permission of the

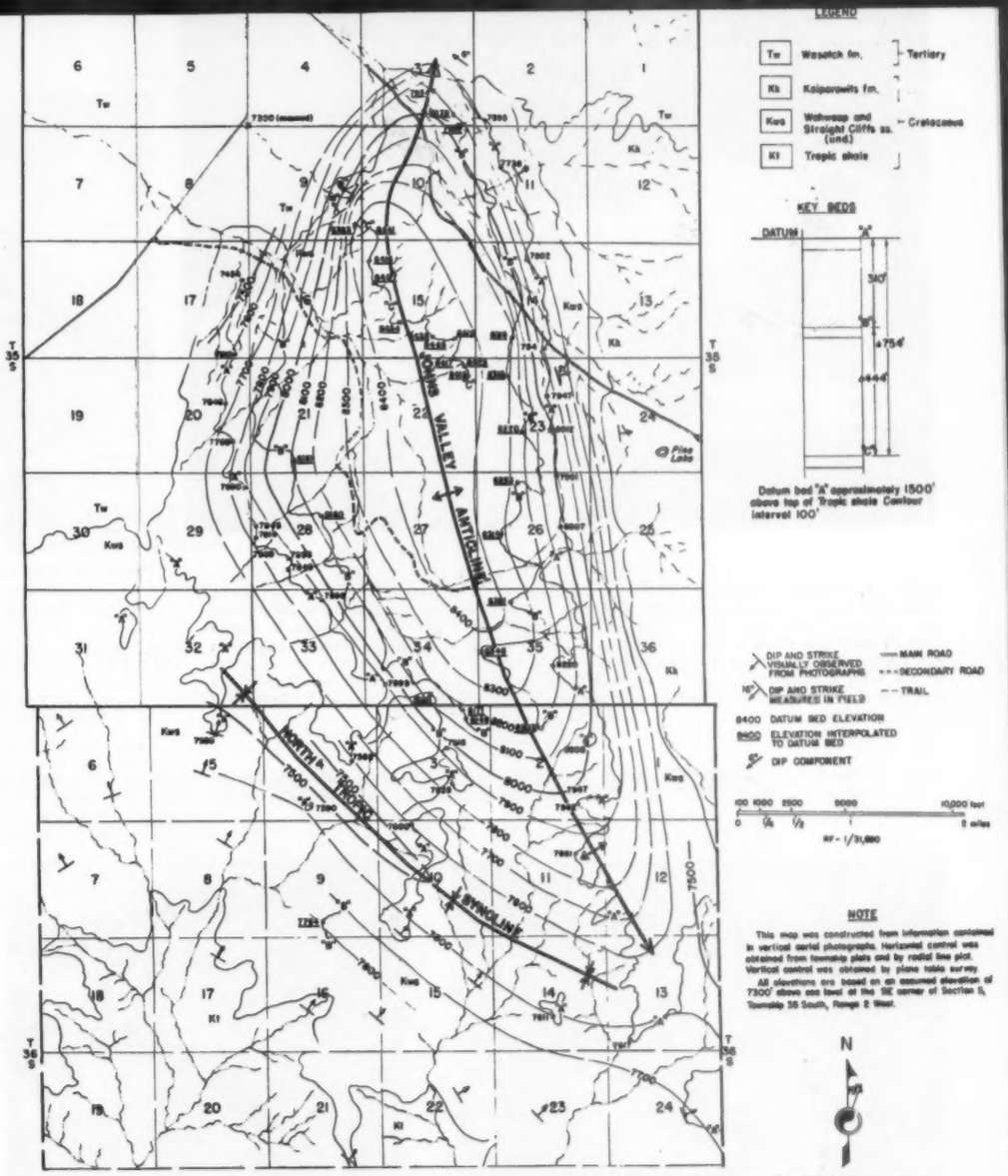


Figure 15: Areal Geology and Structural Contour Map of the Johns Valley area, Garfield County, Utah.

Figure 13: Cretaceous exposures in Irion County, Tex.

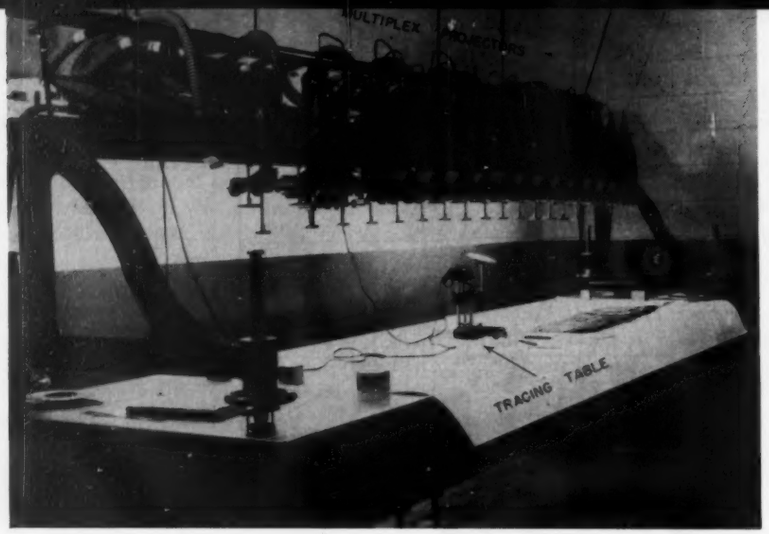


Figure 17: Multiplex instrument. The series of projectors is arranged to project overlapping aerial photographs through small glass diapositives made from the contact prints. Alternating red and blue filters are used in the projectors and when the projected image is viewed through matching filters a third-dimensional terrain model is seen on the table. Topographic maps are drawn by setting the tracing table to any desired elevation and then as the center of the table is brought into contact with the land surface of the projected terrain model, a pencil draws the topographic contour on the map sheet. Photograph courtesy U. S. Geological Survey.

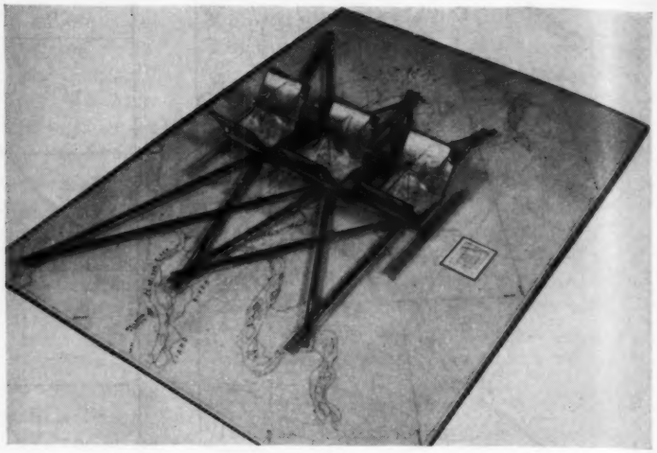


Figure 18: Diagrammatic representation of trimetrogon photography. At each exposure position a vertical photograph and two flanking oblique photographs are obtained. The long template arms intersect at the true-plan position of points on the obliques. Photograph courtesy U. S. Geological Survey.

Figure 16: The K. E. K. plotter in operation. Using photographs taken 12,000 feet above the ground this instrument can produce topographic maps with 20-foot contour interval or spot elevations accurate within five feet. Photo from Phillip Kail, manufacturer, Denver.

Figure 19: Geologic annotations on vertical photograph from trimetrogon coverage of French North Africa. Scale of contact print 1/40,000. See Figure 7 for key to symbols.

government of the country from which photography is desired must be secured before release can be obtained from the U. S. Air Force.

Figure 18 illustrates the principles of trimetrogon photography. Three coordinated cameras are used: a vertical camera flanked by two oblique cameras set at a 60° angle to the vertical. The cameras are equipped with six-inch, wide-angle lenses so that each oblique photograph scans from the edge of the vertical photo to the horizon. In this manner a complete photographic record is obtained extending from the right to left horizons. For maximum effectiveness, the trimetrogon flight lines should not be more than 25 miles apart using a vertical scale of 1/40,000. Trimetrogon photographs are converted into maps by a specialized radial-plot template process in which points of intersection on the oblique photographs are rectified to their approximate true-plan position. Information on the oblique and vertical photographs is transposed to the map by means of a sketchmaster type instrument.

The accuracy of photogeologic evaluation and planimetric mapping from trimetrogon photographs diminishes rapidly in proportion to the distance it is necessary to work out into the obliques.

Trimetrogon photography is an ideal medium for the rapid construction of small-scale base maps, but its value in reconnaissance photogeologic evaluation is generally limited to a large-area, regional type of evaluation. For a preliminary evaluation of this type, the trimetrogon coverage can be used in the delineation of rock outcrops and structural features using such criteria as topographic expression, vegetative differentiation, characteristic tonal expression and any distinctive drainage pattern which may be associated with a particular belt of outcrops.

The "birds'-eye-view" afforded by the obliques will often be of value in a regional appraisal of the area. Structural anomalies may be detected by circular or elliptical patterns disclosing folds, or by straight alignments along faults. However, in areas where the dips are less than five degrees, positive dip and strike evaluation is generally not possible on the trimetrogon obliques.

Because of the rapidity and low cost of trimetrogon evaluation work, it is well suited as a first-phase exploratory tool in large areas where full vertical coverage is not available. After the trimetrogon evaluation has been completed, smaller areas in which structural anomalies are indicated can be selected for photographing at larger scale and full vertical coverage. Figure 19 shows a vertical print from trimetrogon coverage in French North Africa showing a series of steeply folded anticlines and synclines.

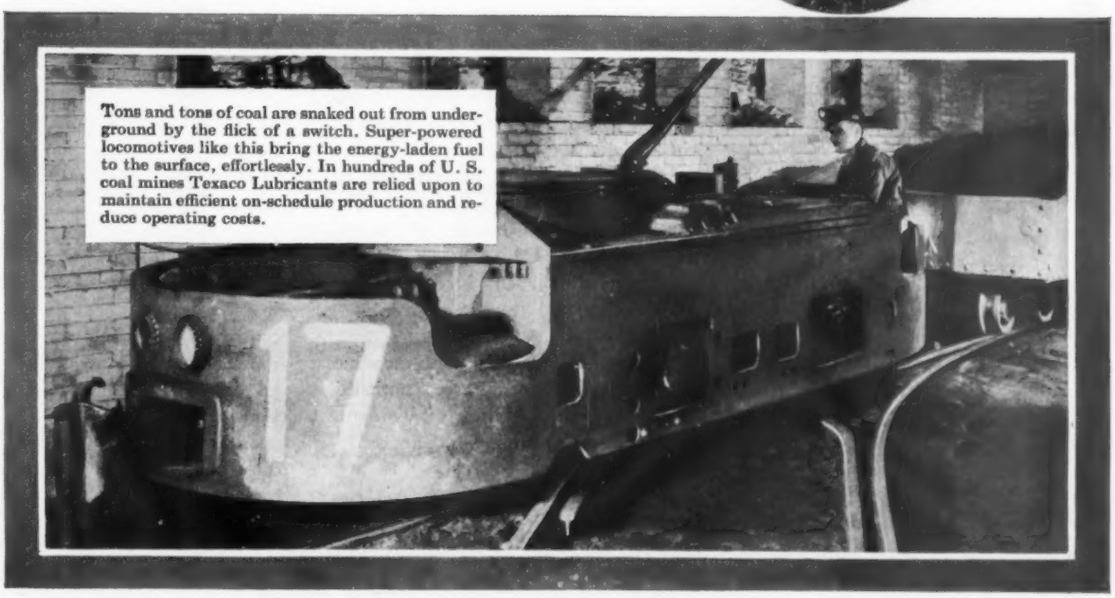
From the foregoing discussion it is evident that photogeologic evaluation can be adapted to a variety of exploratory conditions. The choice of which phase of photogeologic methods to use in any given exploration program will be conditioned by the geologic surface expression of the area under consideration, by the amount of money budgeted and by the type of final map desired.

In many cases a photogeologic "sampling" of areas originally considered unfavorable for the prosecution of photogeologic work has demonstrated to the contrary that much valuable information can be gained through the aerial photographic interpretation.

The widespread acceptance of photogeology as a standard exploration method is due to its low cost and rapidity in comparison with conventional surface mapping. The outlook for its continued use in the future is bright both in the United States and foreign countries.

$\mathcal{R}_x$ for Aching Backs

Petroleum Progress Serves the Mining Industry



Tons and tons of coal are snaked out from underground by the flick of a switch. Super-powered locomotives like this bring the energy-laden fuel to the surface, effortlessly. In hundreds of U. S. coal mines Texaco Lubricants are relied upon to maintain efficient on-schedule production and reduce operating costs.

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WHICH WAY IS ALBERTA GAS TO GO?

By J. L. Irwin

Edmonton, Canada

AT THE close of the Dinning Commission study of Alberta's reserves of natural gas and related matters, the province's total reserve was estimated as four and a quarter trillion cubic feet. That was a year ago. Later in the year it was computed by responsible authorities to have risen to six trillion. The latest estimate exceeds seven trillion. Since the Dinning commission's report, no less than 27 new fields have been established.

It is now calculated by experienced oil men that Alberta, with liberal allowance for growing local demands, has sufficient natural gas not only to supply internal needs for the next century, but also for export without further delay to other Canadian provinces and to the United States. With this position fairly established, three questions are being asked: Which way is the gas to go? Who is going to export it? And when does it start?

Applications from various groups, it is understood, are already before the Petroleum and Natural Gas Conservation Board. Others are said to be in preparation. Until they are all in, the Board apparently will not take action.

To transport natural gas by pipeline to the Pacific coast is a big job. It is big business in preparation and big in operation. Much time is needed for the arrangement of preliminaries such as financing, organization and the determination of routes. Much time also will be required for the construction of gathering lines and construction of main lines out of the province. Not till the finish of all this development, possibly in one or two years' time, will it be possible for the very considerable benefits in revenue returns to the government and to the producers to begin. The hope of the oil industry and the general public is that the launching activities in this direction will meet with no protracted delay.

Who is going to export the gas? Several projects have been worked out for consideration. In one of these, prepared under the supervision of Brokaw, Dixon and McKee of New York, engineers and geologists, three companies are grouped together. They are the North West Natural Gas Company, Alberta Natural Gas Company and Alberta Natural Gas Grid. According to this plan the Alberta Natural Gas Grid will install gathering lines throughout the province from southern Alberta to the Edmonton area and to points north, east and west of this general line as may be decided upon. The pipeline to the Pacific coast will be constructed by the North West Natural Gas Company and the Alberta Natural Gas Company.

These two companies will buy their gas from the gathering lines company, the Alberta Natural Gas Grid. The proposed route is to go through the Crowsnest Pass to Cranbrook, south over the international border at Kingsgate and then west to Spokane. At a point between Kingsgate and Spokane a line will go north to feed the smelter at Trail, a large prospective consumer. From Spokane the line will continue to a point north of Seattle where it will branch, north to Vancouver and south to Seattle and Portland. Connections will extend to points within reasonable proximity of the main line both in Canada and the United States. No distribution of gas will be made at destinations, but it will be sold to the British Columbia Electric in Vancouver, the Seattle Gas Company in that city and to other concerns where deliveries are effected. The North West Natural Gas Company will attend to all sales of gas in the United States, and the Alberta Natural Gas Company in Alberta and British Columbia.

The Prairie Pipe Lines Company, with the same proposed route as the group of three mentioned above, is headed by Glen Wilton of Toronto, lawyer, and Bruce Smith of Edmonton, lawyer.

Transport of gas to the Pacific coast via the Yellowhead Pass is applied for by the West Coast Transmission Company Ltd. Connected with this company are the Pacific Petroleums Company and associates. The proposal of this company is to lay the pipe from some point in the Peace River area to go through north-eastern British Columbia to Jasper, and then via Kamloops to Vancouver. From Vancouver the line is to continue south into the United States.

Another application comes from the Western Pipe Lines of Winnipeg, sponsored by the Baxter group of Winnipeg, for movement of gas from Alberta to Winnipeg and all towns and cities in the vicinity of that route.

There is also an application from the Interfield Gas Lines Ltd., with which H. R. Milner, K.C. of Edmonton is associated. The objective of this company is the establishment of gathering lines and the sale of its gas to long-distance lines.

The argument for the Yellowhead Pass route to the Pacific is that it will be all Canadian, that it will service Alberta communities before it leaves the province and service Vancouver and intervening points before it turns south across the border.

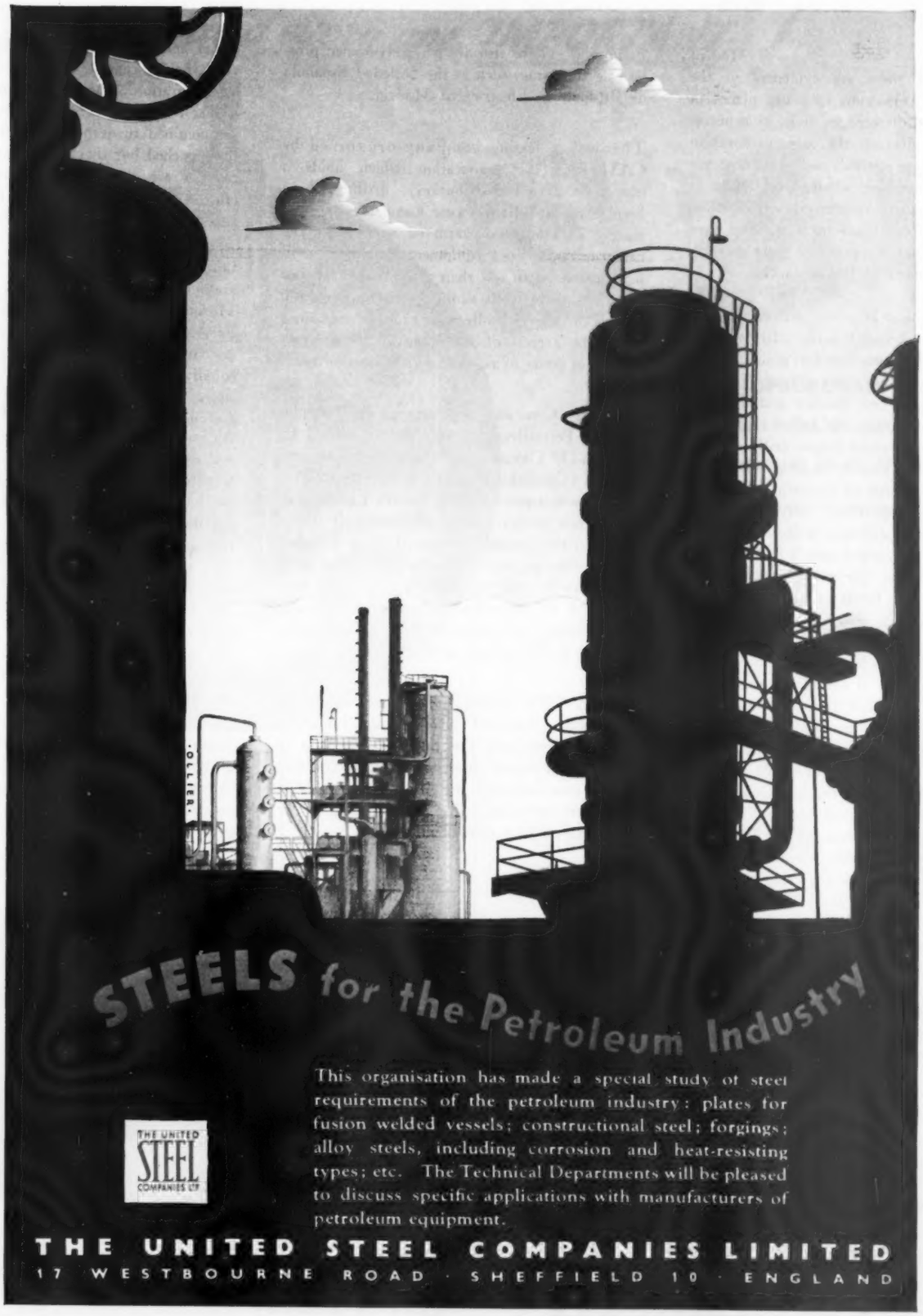
The claim of sponsors of the southern route is that the Yellowhead Pass route would be subject to the hazards of the Frazer River canyon, rock and snow slides, with possible serious consequences. A reply to this criticism has been given to the effect that the Yellowhead Pass route can by-pass the canyon on its way to Vancouver. Advocates of the southern route put forward another claim for consideration in that there are many more cities and towns along this line offering possibilities of substantial consumption. With the extreme cost of construction and administration, the volume of immediate revenues is claimed to be a most important consideration.

Whatever company obtains the contract for this long line will have to purchase gas wherever, and in whatever quantities, the Conservation Board may decide upon.

Sentiment for an all-Canadian route for gas to the coast will have to be balanced against practical considerations of cost and usefulness. Much controversy took place recently regarding the route of the Interprovincial pipeline for oil to the lakehead at Superior, Wisconsin. Had the Canadian route to Fort William been decided upon, it would have cost another $10 million in construction with an extra $400,000 annually in carrying charges, which would have been prohibitive.

The Interprovincial with its water connections offers a commercially practicable route for the eastward movement of oil, at least as far as Ontario, but the same conditions do not apply to gas. A United States company proposes to deliver 75 million cubic feet of gas per day from Texas, in addition to quantities already transported there, to the Union Gas Company of Windsor, Canada, so that points in western Ontario may have a better supply. It might be preferable to collect American dollars for Canadian gas by sales to western cities of the United States and use them for the purchase of American gas to supply points in eastern Canada, than to undertake the tremendous cost of pipelines to move Alberta gas to the eastern provinces.

Dr. Link, well-known consultant geologist of Alberta, anticipates a gas potential of 10 trillion cubic feet in the near future. Pincher Creek has a potential of 1.5 trillion of its own. Growth of western Canada may at some future time provide a different aspect to the movement of gas to distant markets.


STEELS for the Petroleum Industry
This organisation has made a special study of steel requirements of the petroleum industry: plates for fusion welded vessels; constructional steel; forgings; alloy steels, including corrosion and heat-resisting types; etc. The Technical Departments will be pleased to discuss specific applications with manufacturers of petroleum equipment.
THE UNITED STEEL COMPANIES LIMITED
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US 37

SPAIN STEPPING UP ITS SEARCH FOR OIL

By Herbert S. Williamson

Madrid

ALTHOUGH there are evidences of the presence of petroleum in many places in Spain, in the form of seepages or in its penetration of water wells, no thorough exploration employing up-to-date methods and equipment has been made to determine whether oil exists in quantities to justify commercial exploitation. Small finds have been made in Burgos, in Santander, in Alava and Navarre and more recently in several other parts of the peninsula.

These minor deposits at many different points from Andalusia in the south to the valley of Aran in the Pyrenees have been found in practically all cases in wells of shallow depth averaging only a few hundred feet. Their number and distribution, however, encourage the belief that, with more thorough surveys and deeper drilling, more substantial quantities may be located which may lead to the development of domestic production at least of modest proportions. Even a relatively small output from indigenous sources would be a boon to the country, which now is forced to rely wholly on imports and, like many others, is hard put to it to find the funds to pay even for an inadequate supply.

In the past exploration has not been inviting to outside capital because of the terms imposed by Spain's mining law which limited foreign participation in Spanish companies to 25 percent. By special permit this has now been raised to 49 percent, and the organization of subsidiary companies is allowed, which through cooperation among them assures practical control. Modern machinery can now be brought in duty free, classed as "aportacion," which means that a foreign investor's share in the required investment can be made in kind in the form of needed equipment, instead of in money.

Under this liberalization American and other outside capital is taking an interest in the search for oil in the Iberian peninsula, while Spanish companies and even the government itself are renewing their participation in view of the great need for more petroleum products.

Adoption of modern survey methods and equipment as a preliminary to drilling is being encouraged by the Spanish Geological Institute and by the Spanish Institute of Applied Geophysics, the latter under the direction of D. José Cantos Figuerola. There also are privately-owned prospecting companies such as the Sociedad Española de Prospeccion Electrica of Madrid.

Through a leasing company organized by CAMPSA (the corporation which holds a monopoly of oil distribution), drillings have been made at Villanueva de Rampalay, approximately 75 kilometers south of Santander. Because of antiquated equipment employed, drill holes extended to less than a thousand feet, but from the three wells sunk, something over 300 barrels of oil were collected. Further operations await the arrival of an American drilling rig capable of going to a depth of 7,000 feet or more.

CIEPSA (Compañia de Investigacion y Explotaciones Petrolíferas, S.A.), jointly owned by Vacuum Oil Company and the Spanish company, CEPSA (Compañia Española de Petroleos, S.A.) drilled to a depth of 7,622 feet in Lerida near the French border. Although the result was a dry hole, the company is now drilling a second well near Burgo de Osma in the province of Soria which has been carried to a depth of 7,253 feet. Neither J. H. Wardlaw, general supervisor, nor E. H. Smith, the American drilling superintendent, has given up hope of finding production.

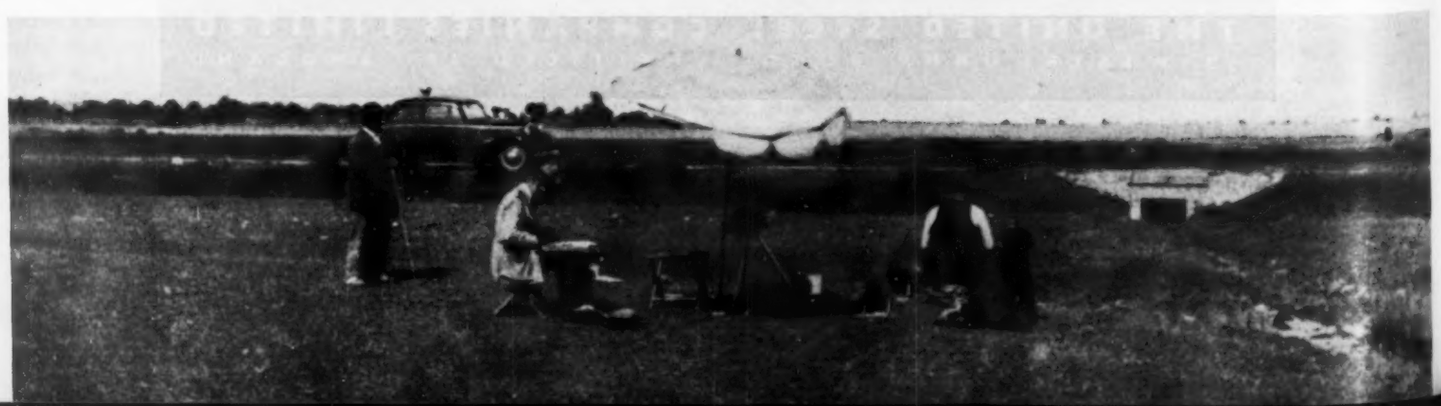
Empresa Adaro, a company sponsored by the official body, Instituto Nacional de Industria, started a well near the town of Chiclana in Cadiz, which found showings of oil at 200 feet and is now awaiting the arrival of American equipment, including drill pipe and casing, before being carried to further depths.

Other companies, backed by American and private Spanish capital, are showing an interest in oil exploration. The general opinion of geologists is that the possibilities of commercial production are confined to deeper zones than those heretofore reached but that the prospects for such discoveries are sufficiently good to justify further efforts with the use of more powerful drilling rigs and other up-to-date equipment.

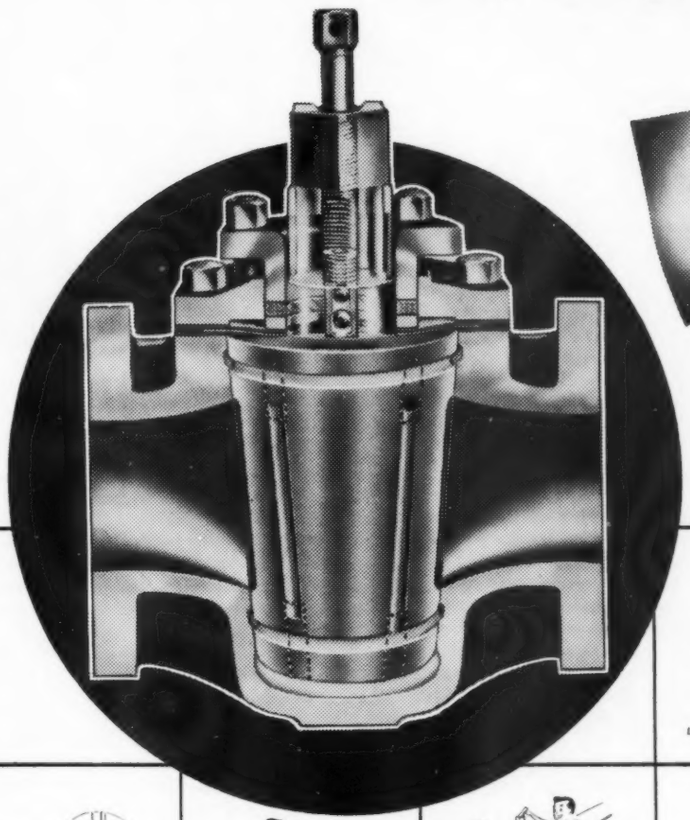
Outside peninsular Spain it is believed that there are good chances of finding oil in Spanish Morocco, in northern Africa. Exploration in French Morocco has had encouraging results, and it is believed that Spanish territory has equally favorable if not better geological conditions. Regarded as promising is the district of the Luccus River and also the section east of the Alcázar and the western part along the coast and extending south to the boundary of the international zone of Tangier. In all of the areas gas has been found and also small showings of oil, but no systematic exploration has been carried out.

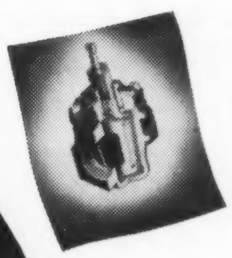
Under present restrictions on import and distribution, Spain's annual consumption is about 800,000 tons (6,000,000 barrels), but this is far below the country's needs for the development of industry and transportation. If oil were freely available, consumption would quickly rise to nearly or quite twice the quantity now used. Spain undoubtedly will have to continue the importation of the major part of its requirements, at least for a long time to come, but if a domestic industry could be developed, it would help to improve the situation.

Seismograph surveys have been conducted in a number of areas. Photographs show such a survey in progress. Instruments are protected from the sun with a large umbrella.

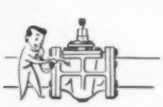
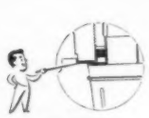
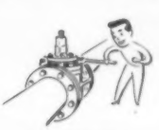
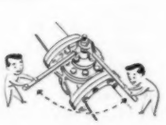


IN NO OTHER VALVE — *So many features and every one* ***IMPORTANT!***





For drilling, production, refining pipe line transmission—servicing gas and petroleum in all its phases

			 **A TIGHT SHUT-OFF ALWAYS** *Lubricant pressure maintains seal*	**CORROSION AND EROSION EFFECTIVELY RESISTED** *Lubricant pressure protects parts*	**REPAIR PARTS AVERAGE ½ OF 1%** *As compared with valve sales*
 **RESILIENT SHOULDER STEM SEAL** *Allows jacking of plug*	**FASTEST CLOSURE IN FRACTION OF USUAL TIME** *Can be closed slow or fast*	**RE-LUBRICATED UNDER PRESSURE** *Ball check valve holds pressure*	**SEAT OF VALVE NEVER EXPOSED** *Line fluid does not contact seat*	 **ADJUSTABLE UNDER ANY PRESSURE** *No need to shut down line*	**REPACKABLE UNDER ANY PRESSURE** *Can be packed in any position*
POSITIVE ROTARY ACTION *Tapered plug, fully lubricated*	 **QUARTER-TURN** *Simple sliding action*	**MOST COMPACT SIZES** *Can be set in restricted space*	**"SEALDPORT" SURROUNDS PORTS** *Seals each port against leakage*	**HYPERMATIC AUTOMATIC LUBRICATION SAVES TIME** *Self-acting, self-feeding*	**LEAST EFFORT TO OPERATE** *Lubricant prevents galling*

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International News and Notes

Burton E. Hull

BURTON E. HULL, president of Trans-Arabian Pipeline Co., was presented with an honor award for notable achievement in pipeline construction by the alumni association of Stevens Institute of Technology at the association's 80th annual dinner at the Hotel Astor, New York. Mr. Hull, also vice president of The Texas Co., and formerly president of the Texas Pipeline Co., directed construction of the "Big Inch" during World War II and is now building the 30-31-inch Trans-Arabian pipeline which will carry oil from Saudi Arabia to the eastern Mediterranean.

Brazil Authorizes Federal Refinery

Purchase deeds for the site of the government's 45,000-barrel refinery were signed at the National Petroleum Council on December 30. The area measures 1,300,000 square meters (300 acres) and is situated in the municipality of Cubatao, between Santos and San Paulo. It adjoins the power station, the railway and the terminus of the projected line.

The deed of lease for the Refinaria do Distrito Federal, which is authorized to erect a refinery of 10,000 barrels daily capacity at Rio de Janeiro, was issued in January. The site at Manguinhos is government shoreland and its price of $1,695,600 U. S. is to be paid in 15 years with interest at 10 percent. The capital of 60 million cruzeiros or $3,240,000 U. S., which it is proposed to increase to 100 million cruzeiros or $5,-500,000 U. S., must be subscribed by native-born Brazilians. The board of seven directors must also be native-born Brazilians, resident in the country. To prospect for oil in Brazil the company will set aside annually an amount corresponding to nine percent on the cif price of crude oil processed by the refinery dur-the preceding year, plus 50 percent of the balance of profits after the statutory transfers to reserves have been made.

New German Find Near Celle

The series of promising oil finds in northwest Germany during the last few months has been continued by the discovery of an oil deposit near Eldingen (about 12 miles to the northeast of Celle) by Gewerkschaft Elwerath. As the recent Suderbruch find, this is another of the new intermediate structures which are not bound up with salt domes. In a Lias sandstone at a depth of 5,250 feet the well Eldingen 1 of Gewerkschaft Elwerath encountered such good oil traces that a production test was carried out. This resulted in a flow of 25 cubic meters of a good quality light crude with high gasoline content. Owing to lack of tank storage the well had to be shut in for the present. According to the measured pressures, it is expected that a regular daily production of about 20 cubic meters can be reached.

New Refinery in Venezuela

Phillips Oil Co., wholly owned subsidiary of Phillips Petroleum Co., has agreed with the Venezuelan government to construct and operate a modern refinery and wax plant in eastern Venezuela in compliance with the terms of the company's oil concession contracts. This plant will manufacture over 2,000,000 pounds of high grade wax per year. Actual construction is expected to begin in 1951 and it should be in operation sometime in 1952.

A major portion of Phillips' present crude oil production in Venezuela contains a relatively large amount of high-grade wax. The proposed plant will be the first commercially to produce such wax in Venezuela. All wax now consumed in the country is imported.

Crude for the refinery and wax plant will be the company's production in its San Roque field located on a 130,000-acre concession in the state of Anzoategui in eastern Venezuela. Phillips has completed 11 wells in this pool producing approximately 6,500 barrels daily. Five drilling rigs are presently being operated in the field. Phillips also is producing oil from its Mata Grande pool in the state of Monagas.

Gelsenberg Resumes Production

The big hydrogenation plant of Gelsenberg near Gelsenkirchen (Ruhr district) which last fall was put on the dismantling list but, in accordance with the Petersberg agreement has been exempted from dismantling, has now definitely received a production permit for the treatment of 15,000 tons of oil residues per month. Gelsenberg, which has a distillation unit, is allowed to distill an amount of crude yielding 15,000 tons residues monthly. Gelsenberg also holds permits for the production of 600 tons of sulfur, 150 tons montan wax and 1,800 tons ammonia sulfate per month. The plant has a contract with Soconv-Vacuum and Standard Esso for close cooperation.

Offers To Take Over De Mares

D. D. Feldman, of Dallas, recently arrived in Bogota to confer with Colombian officials concerning his proposed bid to take over the De Mares concession from Tropical Oil Co. when the concession expires in 1951. Tropical has advised the government that it does not desire to participate in a company jointly owned with the government.

Mr. Feldman has been seeking to enter the Colombian field since 1946 when he offered to build a refinery to process 2.2 million barrels per year of government royalty oil. A proposed contract to build the plant was recommended by the National Petroleum Council but has not yet been approved. The contract as published in "Anales del Congreso" last September offers the government half of the profits for a 20-year period, after deductions for plant amortization. After 20 years, 60 percent of the profit would be given to the government.

In his current negotiations Mr. Feldman is reported willing to invest $25 million in a new company to take over De Mares. The enterprise would be jointly owned by the Colombian government and its nationals.

Basic Limits Scottish Touring

Shortage of petrol is still the major problem facing the tourist industry in Scotland and the handicap limiting further expansion of business. This aspect has been strongly stressed by the Scottish division of the British Hotels and Restaurants Association, meeting in Edinburgh. D. C. Grant of Glasgow pointed out that Basic made it impossible for tourists to travel to the north of Scotland and that motorists simply refused to use public transport and stayed away from Scotland.

J. B. Nolan

J. B. NOLAN, who until recently was area advisor at New York to Standard-Vacuum Oil Co. for the South and East Africa areas, has been appointed chairman of the board and managing director of Vacuum Oil Co. of South Africa Ltd. The company, a subsidiary of Standard-Vacuum, has headquarters at Capetown, to which Mr. Nolan returned several months ago. He succeeds W. G. Allin who has retired after 48 years of service and who started with Vacuum of South Africa as a stenographer in 1902, becoming its managing director in 1940. Mr. Nolan is the first South African-born head of the company, which he joined in 1911.

Marketing operations of the Standard-Vacuum affiliate which now come under Mr. Nolan's direction include activities in the Union of South Africa, Southwest Africa, Bechuanaland, Northern and Southern Rhodesia, Mozambique, Nyasaland, Basutoland, Swaziland, Tanganyika, Kenya, Uganda, Somalia and the islands of Zanzibar, Mauritius, Madagascar, Reunion, St. Helena and Ascension. The area involved totals more than 2,850,000 square miles—nine-tenths the size of the United States—and has a total population of more than 42 millions.

Alberta's Production

Final figures of oil production in Alberta for the year 1949 show a total output of 20,246,466 barrels, valued at $57,999,936. Drillings aggregated 3,212,616 feet, an increase of 1,549,000 feet over 1948. Production by fields was as follows:

Field	Barrels
Turner Valley	4,304,063
Leduc-Woodbend	9,688,784
Redwater	4,793,491
Lloydminster (Alberta side)	716,941
Other fields	743,187
Total	20,246,466

British Oil Fuel Policy

Government policy has been repeated on the subject of substitution of fuel oil for coal in public buildings in the refusal of the secretary of State for Scotland to authorize oil firing in a Fife hospital. The County Council has been pressing for the installation of oil firing here since February 1948 and has been repeatedly refused this facility by the Ministry of Fuel and Power and now by the Secretary of State for Scotland. Ministry policy is that oil fuel shall only be granted where its use will give exceptional economic advantages or where the use of other fuels is impracticable. The advantage of oil fuel is admitted in certain circumstances, but in this case cost was estimated at 50 percent over mechanically fired coal.

This line of 10 GMV's in Royalite Oil Company's station No. 1, Turner Valley, Alberta, includes first 3 GMV's ever built and now totals 6,060 GMV horsepower.

GMV's in service at Royalite are used for gas transmission, underground storage, and in the manufacture of natural gasoline.

Royalite Oil Company's three 11-year-old GMV's, the first ever built, are still in continuous service; have held up so well that visitors can't tell them from the seven since added to this company's No. 1 station. Royalite's other two stations are likewise equipped with Cooper-Bessemer V-angles, Type GMV and the smaller GMX.

The most recent addition to station No. 1* is a GMV Turboflow, installed this past summer. It gives Royalite unprecedented advantages — a full 10% increase in power output compared with other units of equal displacement, plus at least a 15% reduction in fuel consumption.

If your plans call for compressor horsepower, bear in mind that Cooper-Bessemer Turboflow V-angles, GMX, GMV and GMW, are now available in sizes from 200 to 2500 hp. Check on the savings you can show!

*Station No. 1 is now owned by Madison Natural Gas Company, Ltd., a totally owned Royalite subsidiary.

The Cooper-Bessemer Corporation

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New York City Washington, D. C. Bradford, Pa. Parkersburg, W. Va. San Francisco, Calif. Houston, Dallas, Greggton, Pampa and Odessa, Texas Seattle, Wash. Tulsa, Okla. Shreveport, La. St. Louis, Mo. Los Angeles, Calif. Caracas, Venezuela Gloucester, Mass. Calmes Engineering Co., New Orleans, La.

H. W. Haight

Haight Elected Creole Executive VP

H. W. Haight has been elected executive vice president of Creole Petroleum Corp. Mr. Haight has been active in the oil industry since May 1927, when he joined the Cia. Transcontinental de Petroleo S.A., an affiliate of the Standard Oil Co. (N. J.), as a torsion balance helper. He subsequently served as a geologist with this same company and in 1937 was transferred to the Standard Oil Co. of Egypt as field superintendent. A year later he became manager and chief geologist of that company. Mr. Haight joined Creole in 1945 and was elected vice president and director in charge of operations in Venezuela in June of the following year. He will continue to reside in Venezuela and in the absence of the president for any cause will assume the duties of that office.

65 Exhibitors At Auto Show

Sixty-five leading British automotive manufacturers, including 19 auto makers, will participate in the British Automobile and Motor Cycle Show at Grand Central Palace at New York April 15-23. Nearly a hundred automobiles, in addition to trucks, buses, trailers, accessories and garage equipment, motorcycles and bicycles, and full lines of diesel engines will be shown at the Palace.

Last year Britain exported 258,000 cars and 93,000 trucks, valued at $485,633,548 to set a world's record for auto exports. Total production for 1949 was 412,290 cars and 218,375 buses and trucks, highest in history.

British heavy commercial vehicles will be represented in New York by Leyland Motors Ltd. No less than five diesel-engined vehicles as well as a representative range of industrial and marine power plants will be exhibited by this company. Three of the vehicles and the power units will be shipped complete across the Atlantic; two Comet trucks will be assembled at the Leyland subsidiary factory in Canada and will be sent from there direct to the show. Included will be a self-loading oilfields truck which is a six-wheeled Super Hippo chassis with double drive rear bogie. Equipped with a heavy-gauge steel platform body and carrying gin poles and a winch for hoisting oilfield machinery, the truck is suitable for operating over roadless country under arduous conditions.

New Tanker Ordered

John Brown and Co. Ltd. is to build a 19,000-ton deadweight oil tanker at its Clydebank, Scotland, yard for the Tidewater Commercial Co. Inc. of Baltimore, Md. Machinery is to be single-screw Brown-Oxford diesel engines giving a speed of some 15½ knots.

Brazil Considers Increased Fuel Taxes

A proposal has been placed before the Brazilian Congress to increase the taxes on imports of petroleum products per ton, as follows: gasoline from $45.37 to $55; kerosene from $20.90 to $22; diesel oil from $4.68 to $11; heating oil from $3.58 to $11; lubricating oil from $25.85 to $82.50. By a decree issued in 1945, proceeds of the fuel tax are placed at the disposal of the national highway department, 60 percent of the amount being allotted to states and municipalities for road building and maintenance. By 1949 the fund had grown to over 1,000 million cruzeiros, equivalent to roundly $55,000,000. The proposed tax measure, if adopted, would substantially increase the sums available for highway improvement.

Electrical Resistance Alloys

Samuel Fox & Co. Ltd. near Sheffield, England, has published an 80-page report on the properties of its special Red Fox electrical resistance alloys. Through a 40-year period of intensive research, the company has developed a group of special alloys including a new chromium-iron-aluminum alloy, Red Fox 135, which is suitable for temperatures up to 1,300° C and superior in many respects to conventional nickel-chromium alloys. Red Fox 135 was developed in cooperation with United Steel Companies Ltd.

Red Fox Electrical Resistance Alloys report contains tables which provide essential information required in the application of various alloys by designers of electrical heating elements. Authors of the report have developed curves and tables dealing with mechanical properties of the alloys, the effects of temperature on electrical resistance and similar information. In addition the company offers technical assistance to designers through the Samuel Fox research laboratories. Copies of the report are available on request.

Organizes French Subsidiary

Foster Wheeler Corp., New York, has organized a French subsidiary, Société Foster Wheeler Française, for handling European construction activities, according to Earle W. Mills, president of the parent corporation. The French company will maintain offices at 6, Rond Point des Champs Elysées in Paris. R. M. Serre will direct the sales work on the continent of Europe with headquarters at the Paris office.

In making the announcement Mr. Mills pointed out that Societé Foster Wheeler Française will provide the clients with more efficient service under the direction of personnel with American engineering experience and know-how. The French company will also provide facilities for European manufacture and make available to the European operator the latest developments and refinements in American design of power plants, chemical plants and oil refineries.

Société Foster Wheeler Française will receive the basic engineering from the parent corporation but will be organized to handle the detailed engineering and construction of the plants with French personnel, the announcement said.

Kuwait Crude Output

December crude oil production in the Persian Gulf Sheikdom of Kuwait amounted to 885,408 tons, the Gulf Oil Corp. announced on behalf of the Kuwait Oil Co. Ltd., London. Total production for the year 1949 amounted to 6,291,577 tons, which is equivalent to approximately 46,500,000 barrels of crude oil.

Production for the last six months of the year amounted to 4,260,443 tons, an increase of more than 200 percent over the production for the first six months, which was 2,031,134 tons.

Iranian Output Up 7.7 Percent In 1949

Crude production in Iran totaled 205,093,550 barrels in 1949, according to preliminary figures announced by Anglo-Iranian Oil Co. Ltd. This is an increase of 14,829,956 barrels or 7.7 percent over the 190,263,594-barrel total produced in 1948. Daily average production in December was 605,000 barrels compared with 562,000 barrels daily for the year 1949 and 554,000 barrels daily in December 1948.

Dunkirk Refinery In Operation

Recent arrival at the port of Dunkirk of the first cargo of crude from the Persian Gulf marked a further important step in the restoration of the French refining industry with the start of operations in January of the new plant of Soc. Générale des Huiles de Pétrole, French affiliate of Anglo-Iranian Oil Co. Ltd.

The refinery occupies the site of the former Raffinerie de Pétrole du Nord which was destroyed during the war. It was built to operate as a unit with the nearby refinery at Courchelettes, which was also severely damaged during the war.

Construction of the new plant began in 1948 with the erection of a crude distillation unit transferred from Courchelettes, to which additional refining equipment and the necessary service facilities have been added. It will operate initially at a rate of 300,000 tons a year. By autumn 1951 scheduled capacity will be raised to 1,400,000 tons a year. The refinery will manufacture a complete range of products, including bottled gas, solvents and lubricants. It will have a large gasoline capacity which will enable it to produce both motor and aviation spirit.

Council Adopts Emblem

The Council of British Manufacturers of Petroleum Equipment has adopted an emblem to be used as a badge of membership. It is the outcome of suggestions made at the 1949 annual general meeting. In view of the obvious difficulties, it was felt that no attempt at symbolism should be made, and the badge has been kept simple.

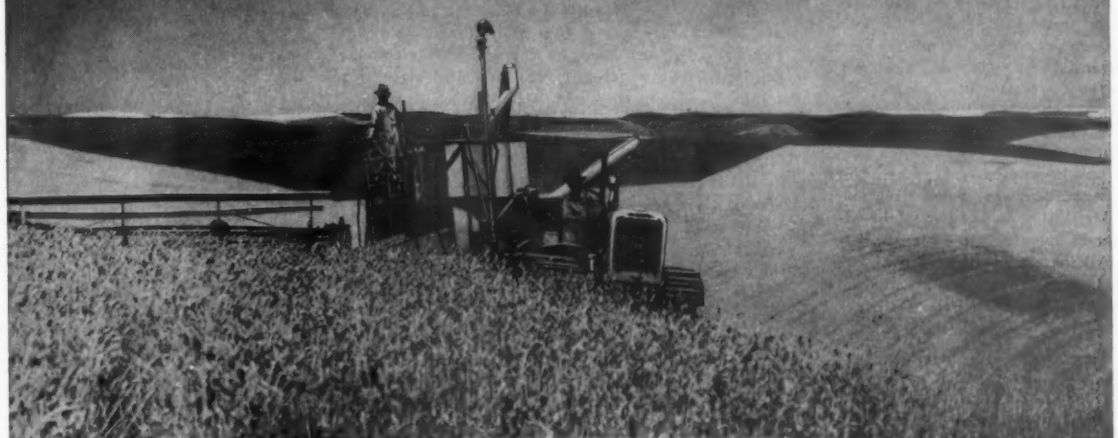
As the result of two recent meetings, two regional committees have successfully been reformed, in addition to those centered on Birmingham and Manchester and working so energetically under the regional chairmanship respectively of Edward Thompson (John Thompson Ltd.) and Donald Bailey (Sir W. H. Bailey & Co. Ltd.)

The new committees will provide a focus for members on the northeast coast and in Scotland. They are headed by L. T. Morton, Clarke, Chapman & Co. Ltd., and by R. Gourlay, A. F. Craig & Co. Ltd. Both planned meetings for members in their areas in March. Dr. H. B. Footner of Shell Petroleum Co. was to speak to members in Glasgow on aspects of corrosion control. D. D. Margules of The Lummus Co. was to address members in Newcastle on "Contracting Engineers and Council Members."

Emblem of Council of British Manufacturers of Petroleum Equipment.

PLOWING BACK PAYS OFF

TODAY, IN OIL AS IN FOOD—All America Reaps the Benefits of Planning Ahead!



DURING and after the war, as everyone knows, oil needs skyrocketed. They are still climbing.

In 1948, Socony-Vacuum plowed back $201,000,000 into the business — expanded all facilities to handle unprecedented demand.

Again, in 1949, we plowed back $158,000,000 to improve still further our efficient, integrated operation, and so assure a continuous flow of high-quality oil products.

This is the kind of "plowing back" that builds for the future . . . that makes for National Security . . . that assures oil supply for growing millions of cars, homes and mechanized farms, for expanding aviation and *every* industry that relies on *more oil* to produce a bigger money's-worth for you.

America is already reaping the benefits, and more and more benefits are coming.

★ ★ ★

Socony-Vacuum, as one of the oldest petroleum companies, is proud of the part it has played in a progressive industry — will continue to look ahead and plow back.

The Sign the Nation Knows — Builds as the Nation Grows!

SOCONY-VACUUM

The Flying Red Horse Companies

SOCONY-VACUUM OIL COMPANY, INC.

and Affiliates: MAGNOLIA PETROLEUM CO. • GENERAL PETROLEUM CORP.

OIL COMPANY STAFF CHANGES

Ira H. Cram

Frank J. Whitley

Continental Appointments

Appointment of Ira H. Cram, Houston, to the newly created position of vice president in charge of Continental Oil Company's production department has been announced by President L. F. McCollum. Mr. Cram will also continue as vice president in charge of the company's exploration, it is stated.

O. L. Fisher, assistant manager of Continental's production department, has been promoted to assistant regional general manager, southern region, Houston. In his new position Mr. Fisher will assist in the direction of all Continental's operations in Texas, Louisiana, New Mexico, Arkansas and Mississippi. Mr. Fisher will be succeeded as assistant manager of the production department by H. H. Hinson, chief production research engineer, formerly with the U. S. Bureau of Mines.

JOSEPH H. SALMON, until recently assistant to the president and economic adviser of Shell Oil Co., has opened offices as management consultant at 201 East 57th Street, New York City. He will specialize in the oil, gas, chemical and allied industries. Mr. Salmon was with Shell for about 27 years, successively serving as assistant to the chief engineer, assistant to the manufacturing vice president, manager of transportation and supplies department, chairman of the long range planning committee, chairman of the economics committee and as assistant to the president and economic adviser. He was for a number of years a member of the company executive committee. During the early period of the war he served as chief of the petroleum price section of the OPA at Washington. Later he was in Shell's Washington office representing the company with government agencies and serving on various industry committees.

G. E. BURPEE, area production manager for Shell Oil Co. at Houston, has been transferred to Calgary, Alberta, where he will be in charge of western Canadian operations. He is succeeded at Houston by C. P. Bristol, formerly chief exploitation engineer in the Houston area.

R. W. BRANDT has been appointed manager of LP-Gas sales for Cities Service Oil Co. Mr. Brandt joined Cities Service about a year ago after having served most all of his business career in the field of LP-Gas sales and engineering. He served as district manager of LP-Gas sales for Phillips Petroleum Co. and United Petroleum Gas Co. and chief engineer for Ruland Gas Co. at Charlotte, N. C. Cities Service Oil Co.'s production of LP-Gas has been increased more than 50 percent the past year through the construction of new plants and the emphasis on LP-Gas production at existing plants.

FRANK J. WHITLEY has resigned as assistant to the vice president and manager of operations for J. S. Abercrombie Co., Houston, to become vice president and general manager of B B M Drilling Co., a new company. He has been in charge of Abercrombie drilling since returning to the company after war service in the Navy. Other B B M officers are Paul F. Barnhart, president, and David G. Baird, vice president. V. V. Thomasson is drilling superintendent.

C. RICHARD COSLOW, assistant industrial relations advisor in the foreign trade department, Socony-Vacuum Oil Co. Inc., was transferred March 15 to assistant general manager of the company's operations in Austria. He will become general manager Dec. 1 with retirement of H. P. Rudinger.

P. SUPERTY JR. has been appointed general auditor of the Gulf Companies. He will transfer from New York, where he has been district accounting manager, to Pittsburgh. J. T. McMahon has been named to succeed Mr. Superty at New York.

JOHN F. WALTON JR. has been elected a director of Gulf Oil Corp. Mr. Walton entered the employ of Gulf in 1940 as a member of its sales department and rose to an important position in the management of that department, from which position he recently resigned.

CARL A. HOUY, who began as a roughneck in the Texas oil fields 13 years ago, has been appointed general superintendent of crude oil production for Deep Rock Oil Corp. Mr. Houy began his career with the Humble Oil and Refining Co. at Refugio, Texas, in 1937. In 1940 he transferred to the Republic Natural Gas Co. at Dallas as engineer and assistant superintendent. He was vice president in charge of gas engineering, production and supply at the time he joined Deep Rock.

WAYNE A. HOWARD has been appointed secretary of the manufacturing committee, Socony-Vacuum Oil Co. Inc., succeeding W. H. Zabriskie, who retired March 7. Mr. Zabriskie has been with the company since 1914.

EDWARD J. NOPPER has been appointed assistant chief engineer of Sun Oil Co.'s manufacturing department. He joined Susquehanna Pipe Line Co. in 1932 and transferred to Sun in 1935.

K. H. SHAFFER has been appointed assistant general manager of Standard Oil Co. of California's producing department. He joined the company in 1929 and has worked in South America and California. For the past two years he has been northern district manager at Taft, Calif. C. W. Gibbs has been named to succeed him there.

T. G. STEVENIN has been named plant technologist for Deep Rock Oil Corp., Cushing, Okla., and J. W. Beam, formerly instrument engineer with Universal Oil Products Co., has been appointed supervisor of the instrument department. Mr. Stevenin has had experience in Standard Oil Co. of Indiana's Whiting refinery and as process engineer for Phillips Petroleum Co. More recently he has done government research work.

LESTER B. JOHNSON has been appointed foreign exchange manager of Standard Oil Co. (N. J.) Previously he was senior foreign exchange analyst for the European and North African area. He is succeeded as senior foreign exchange analyst by Allan W. Hamilton of Bronxville, N. Y., formerly a junior analyst.

WILLIAM L. CONNELLY has resigned as chairman and as a director of Sinclair Oil & Gas Co. and will devote his time to special work for the company. Mr. Connelly has been with Sinclair since 1906 and has been engaged in the oil business for 58 years. He served as an officer of a number of the original Sinclair companies including Sinclair Mexican Oil Corp. and Venezuelan Petroleum Co. When the Prairie Oil & Gas Co. was merged with Sinclair, he became chairman of Sinclair Prairie Oil Co.

JAMES C. CRAIG, Continental Oil Company's superintendent of offshore drilling operations, and John H. Davis, district geologist for the company's Gulf Coast marine district, have been assigned to represent the company in its joint operations with Magnolia Petroleum Company off the coast of Louisiana, in which Continental recently acquired a substantial interest. Mr. Davis, prior to his appointment as district geologist of the newly-formed Gulf Coast marine district, was stationed at Lafayette, La. Mr. Craig became superintendent of Continental's offshore drilling operations in 1948. With his new assignment he, like Mr. Davis, will make his headquarters in Morgan City, La.

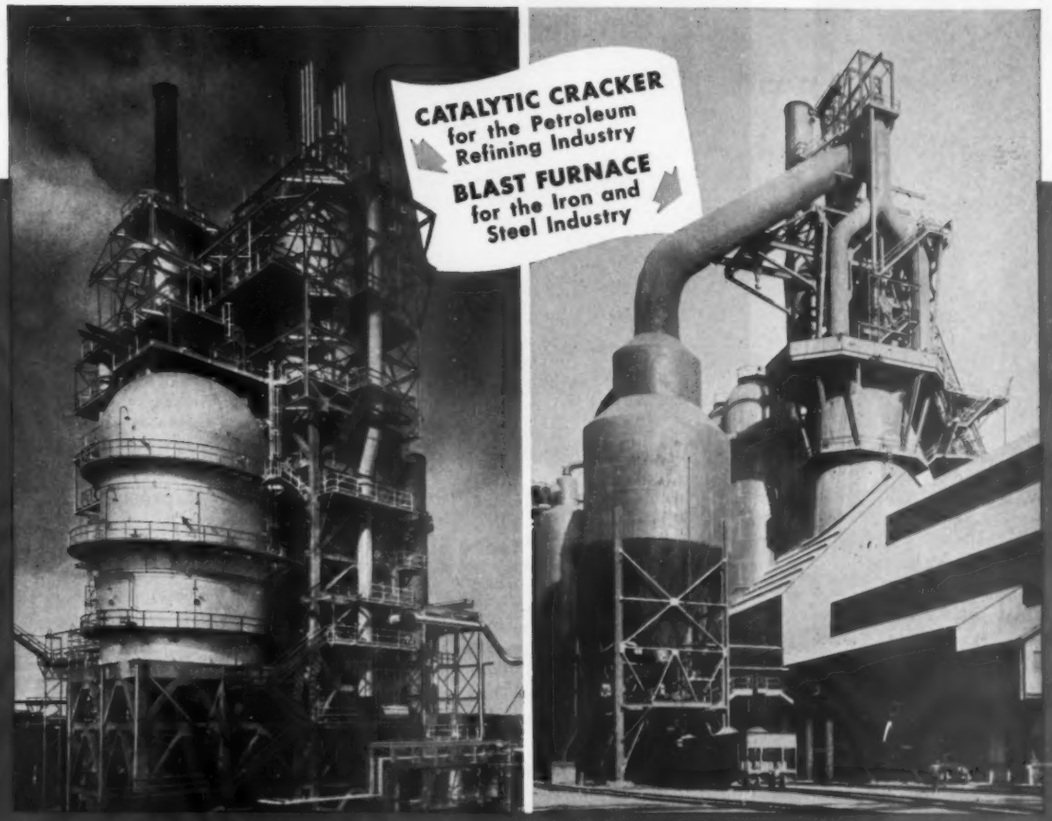
FOSTER C. WHITESIDE of Tulsa has been appointed chief engineer of Continental Oil Company's pipeline department, it was announced by A. C. Wilkinson, manager. Mr. Whiteside resigned as assistant chief engineer of Interstate Oil Pipe Line Co., Tulsa, to accept the new position. After several years in Oklahoma, Mr. Whiteside went to Venezuela in 1941 as safety engineer for the Standard Oil Co. of Venezuela. He returned to the United States on an assignment with the Plantation Pipe Line Co. in 1943 and transferred in 1945 to Interstate.

Hydrocol Personnel Appointments

The transfer of a number of Stanolind Oil and Gas Co. employees to the new chemical plant at Brownsville, Texas, has been announced by Dr. Donald G. Zink, general superintendent of Stanolind's chemical products department. John G. Munson, who was field project engineer during the construction of the plant, has been named assistant plant superintendent. Other men being transferred to the chemical plant staff are: George R. Ayton, Joe C. Weaver Jr., Lloyd Christensen, Raymond S. Tolson Jr., George C. Merrick and Max A. Meek.

George Ayton, formerly technical group leader in the synthesis pilot plant at the Tulsa research laboratory, will supervise the chemical operations sections at Brownsville. Joe Weaver Jr. will be chemical process supervisor at the plant. He was senior chemical engineer at the Tulsa research laboratory before being transferred to Brownsville. Chemical plant laboratory operations will be supervised by Lloyd Christensen.

George Merrick will be industrial relations supervisor for the chemical plant. Safety and plant protection problems will be under the direction of Raymond S. Tolson. Max Meek will head the plant accounting system. These men, together with L. L. Smith, plant superintendent, will comprise the supervisory personnel at the Stanolind plant.



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Earle W. Mills

David McCulloch

New Officers for Foster Wheeler

Vice Admiral Earle W. Mills, USN (Ret.) has been elected president of Foster Wheeler Corporation to succeed the late Harry S. Brown. David McCulloch took Mr. Brown's place as chairman of the board. Admiral Mills had been executive vice president of the corporation since March 1949, and Mr. McCulloch had been vice chairman of the board.

Mr. Brown died suddenly on February 18, 1950. His last official act for the company was the completion and signing of the annual report for 1949, which showed net billings for the year of $77,436,911, highest in the corporation's history. More than half of the total represented billings for processing plants constructed for the petroleum industry. Net income was $3,894,291 equal after preferred stock requirements to $13.24 on outstanding common shares. Current assets at December 31, 1949, were $25,759,428 against current liabilities of $10,737,944. Earned surplus of that date amounted to $14,791,610.

Inasmuch as the report was prepared under Mr. Brown's direction and was in itself a tribute to his management of the company, the board decided to issue it over his signature, although it was published after his demise.

C. E. RIDDELL has recently been assigned as manager of Brazilian and Chilean operations of United Geophysical Co. Inc., with headquarters in Rio de Janeiro. He has replaced Lawrence K. Morris, who is returning for an assignment in United's main office in Pasadena after six years in South America.

M. P. JONES has resigned as president of Geotechnical Exploration Corp. to establish offices at 3552 Rankin, Dallas, Texas, as a consultant. He is engaged in various phases of geophysical exploration and research.

Charles W. Hadley

Charles W. Hadley, who was chairman of the producing and manufacturing committee, Socony-Vacuum Oil Co., Inc., when he retired in 1935 after 45 years with the company, was killed when his car overturned as the result of a blow-out near Pecos Canyon, Texas, March 2. He lived at 16 Maple Hill Drive, Larchmont, N. Y.

Kerotest District Manager

E. T. Adams has been appointed district manager of oil country valve sales in the Houston territory by Kerotest Manufacturing Co. He had been director of purchases and production control at the home offices in Pittsburgh. Formerly with several oil firms in South America, he joined the valve manufacturing company in 1945.

Flaschar Heads Stacey Brothers

Eric A. Flaschar has been elected president of The Stacey Bros. Gas Construction Co., Cincinnati, to succeed William E. Gruening, according to an announcement by J. B. O'Connor, chairman of Stacey Bros. and executive vice president of Dresser Industries, Inc., of which Stacey Bros. is a subsidiary. Arthur E. Harvey was advanced from vice president to executive vice president, and Herbert C. Brinkman from chief engineer to vice president.

Mr. Flaschar has been general manager of the Stacey Dresser Engineering Division of Stacey Bros. During the war he worked with Defense Plant Corp. and as executive vice president of Hydrocarbon Research Inc. In 1945 he undertook a special mission for the War Department. Previously he had participated in oil refinery construction at home, on the continent and in the Middle East for M. W. Kellogg Co.

Stone & Webster Elects Ryan

William F. Ryan has been elected a vice president of Stone & Webster Engineering Corp. Mr. Ryan, broadly experienced in the power, industrial and chemical engineering fields, joined the organization in 1929 as a mechanical engineer, subsequently being responsible for the design of several heavy chemical plants and a number of steam power stations for public utility and industrial clients. He became assistant chief mechanical engineer in 1941, assistant engineering manager in 1945 and engineering manager in 1948. In the latter capacity he will continue to be responsible for the activities of the engineering department with his headquarters in the Boston office.

William F. Ryan

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Henry Dundas

Henry Dundas, a former director and vice president of Standard-Vacuum Oil Co., died on February 12 at St. Francis Hospital, Miami Beach, Florida, at the age of 72. Prior to his retirement in 1942 he had been associated with the international petroleum industry for 40 years. A native of Glasgow, Scotland, Mr. Dundas joined the India staff of Standard Oil Co. of New York in 1900. He participated closely in the subsequent development of that company's marketing organization throughout India. He returned to New York in 1914.

Emil Skarda Joins Reco

Refrigeration Engineering Corp., Philadelphia, has appointed Emil F. Skarda as manager of its international division. Mr. Skarda has been until recently export manager of Wilson Refrigeration Inc. and has had worldwide experience establishing a network of distributors.

Represents Exploration Surveys

Exploration Surveys Inc. has appointed George M. Lisle as its sales representative for Oklahoma in an expanded sales program for its gravimetric and magnetic surveys and reports. Prior to his employment with Exploration Surveys, he was a sales representative for Continental Corp.

C C LISTER, manager of foreign operations, United Geophysical Co. Inc., has just returned from a trip to South America, which included an inspection of United's operations in Venezuela and Brazil.

F. E. ROSENSTIEHL has been appointed manager of the lubrication sales division of The Texas Co. He was first employed by the company in 1918 in the Bayonne laboratory. He became assistant manager of the technical and research division in 1942.

Grove Heads Fiberglas Exports

Keith O. Grove has been appointed manager of the export division of Owens-Corning Fiberglas Corp. He succeeds Gerard de Piolenc who has been named assistant director of research. Export division offices have been transferred from the Toledo general offices to New York in the Fiberglas Building, 16 E. 56th St.

T. D. Collins Elected IDECO Director

T. D. "Hi" Collins has been named a director of the International Derrick and Equipment Co. Mr. Collins is a veteran of more than 20 years in the oil field supply business. He was for many years associated with Continental Supply Co. As vice president of IDECO, Mr. Collins is in charge of the supply stores division.

T. D. Collins

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Every model *Heavy-Duty Engineered*
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All-new, all-proved Internationals have been through a test program directed by men who have devoted years to development of better truck transportation. All outdoors was used for proving grounds. Laboratory analysis was followed by track tests, then by actual road tests. Test convoys were run around the clock. Every new International Truck is right and ready for you *now!*

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Cooper-Bessemer Gets Mid-Valley Contract

Cooper-Bessemer Corp., Mt. Vernon, Ohio, has been awarded a contract by the Mid-Valley Pipe Line for gas-diesel engines to be installed on Mid-Valley's 22-inch, 1,000-mile oil pipeline from Longview, Texas, to Lima, Ohio. Operating on a dual-fuel principle, the engines run on a mixture of natural gas and crude oil. In event of restriction in natural gas supplies, as possible during critical winter months, the Cooper-Bessemer gas-diesels scheduled for the Mid-Valley line will be able to continue running on crude oil alone. Natural gas for operation will be drawn from nearby gas transmission lines of the Texas Gas Transmission Corp. and the Tennessee Gas Transmission Corp. Oil for fuel will be bled directly from the Mid-Valley line.

Scheduled for delivery in May, the gas-diesel engines totaling over 10,000 horsepower are to be installed in four of the seven pumping stations this summer. The first station at Longview, Texas, will alone have sufficient capacity to fill the pipeline with crude oil and pump the oil to Lima, Ohio, at a rate of 50,000 barrels a day. When other stations are cut into the line, this daily output will be progressively increased until an anticipated 200,000 barrels a day is reached for delivery to Sun Oil Co. and Sohio refineries in Ohio.

Texaco Sales Training Program

Observing that 65 percent of its salesmen have had no real experience in competitive selling, The Texas Co. conducted an intensive educational campaign in advance of the announcement of its new "Custom-Made Havoline." Preliminary meetings were held in 15 sales districts followed by 900 dealer meetings, at which more than 70,000 Texaco dealers were told of the improved properties of the new, premium, heavy-duty oil. Modern visual education methods were used. Motion picture showings occupied nearly 2½ hours, and the question period and general discussion sometimes stretched meetings out to nearly four hours.

Texaco sales promotion personnel told district salesmen and dealers that the new Havoline contains newly developed additives which have been tested on the road for nearly four million miles as well as in laboratory apparatus. Although the new oil has greatly increased load-carrying and rust-proofing characteristics, Texaco salesmen are urging motorists to drain their crankcases more frequently to avoid damage to the engine from road dust. It is pointed out that the extra cost of draining at 1,000-mile intervals instead of at 5,000-mile intervals is only 71 cents per month to the average motorist who drives about 10,000 miles per year.

World Oil Geography

A new geography of world petroleum has just been completed by a group of geologists under the sponsorship of the American Geographical Society. The comprehensive volume, titled World Geography of Petroleum, will be published in early 1950 by Princeton University Press. The work was prepared under the editorship of the well-known geologist, Wallace Pratt, with the assistance of Miss Dorothy Good of the American Geographical Society, and will contain much new material, including fifty specially prepared maps and numerous tables and diagrams.

Sovac Radiant Launched

The supertanker "Sovac Radiant," built for Tankers Navigation Co. Inc., was launched by the Sun Shipbuilding and Dry Dock Co. on March 8. This is the last of the eleven large tankers which have been under construction at Sun Ship during the past two years. Sponsor at the launching was Mrs. Albert L. Nickerson, wife of a director and executive of the Socony-Vacuum Oil Co. in charge of domestic marketing. Capable of carrying approximately 10 million gallons of petroleum, the "Sovac Radiant" has a length of 600 feet, 82.6 beam and 42.6 depth.

Rewards of Wildcatting
WHEN the wildcatter strikes it rich, he's glad he used Youngstown. Tried and trusted, this top quality pipe is a true friend--dependable no matter what. Youngstown Oil Country Tubular Goods--drill pipe, casing, tubing,--will help realize the rewards of wildcatting.
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Left to right: T. Cortlandt Williams, Lockwood J. Towne Karl Finsterbusch

Elected to Stone & Webster Board

Stone & Webster Engineering Corp. announced the election to its board of directors of T. Cortlandt Williams of Boston and Lockwood J. Towne and Karl Finsterbusch of New York. All are vice presidents of the corporation, Mr. Williams being in charge of its construction operations; Mr. Towne, who is also construction manager, having the executive direction of important construction projects in the United States and Canada, and Mr. Finsterbusch being responsible for the process engineering work of the organization.

Radioisotopes Booklet

A general survey of the tracer and control work being done with radioisotopes has just been published by The Kellex Corp., the atomic energy engineering firm of 233 Broadway, New York City. Copies are available on request. In the petroleum industry tracers have been used in the laboratory to tag and follow hydrocarbons through various processes. In this connection Kellex is able to contribute to the development work being done by its parent company, The M. W. Kellogg Co., refinery and chemical engineers of Jersey City, N. J.

LP-Gas Consumption in 1949

Consumption of liquefied petroleum gases in the United States increased 8.5 percent in 1949 to 2,725 million gallons, according to estimates prepared by K. W. Rugh and E. O. Mattocks of Phillips Petroleum Co. The increase was modest as compared with the 25 to 40 percent rate of rise in recent years. New gas lines and mild weather cut into the market.

At the end of the year there were 6.5 million homes burning LP-Gas, and domestic consumption during the year was up 12 per cent to 1,650 million gallons. Industrial use increased only 0.3 percent to 310 million gallons, and gas manufacturing use rose one percent to 240 million gallons. With a number of new chemical plants coming on stream during the year, chemical use totaled 525 million gallons, an increase of 6.9 percent over 1948.

Gasoline Survey Results Announced

The DuPont Company's petroleum chemicals division has completed a report on the second of its series of nationwide gasoline surveys. The report gives motor and research octane numbers and tetraethyl lead content for 552 samples of gasoline retailed in 35 cities in the United States and two in Canada. The samples were purchased between Dec. 30 and Jan. 5, and tests were completed in five district laboratories by Jan. 14.

Cost of Petrochemical Plants

The Bureau of Mines has issued its Information Circular 7561, October, 1949, entitled, "Bibliography of Investment and Operating Costs for Chemical and Petroleum Plants"; 185 recent books and articles are cited. Cost of working processes, buildings, towers and individual pieces of equipment, such as gas holders, fencing and even flow meters, are indexed for consultation.

New Charts Aid in Tower Design

The large volumes of charts containing liquid-vapor equilibrium constants, and one large volume containing fugacities for light hydrocarbons in mixtures, have just been published by The M. W. Kellogg Co. The charts are based on the Kellogg Equation of State and have been checked by application to multi-component experimental work performed in Kellogg laboratories and in various universities.

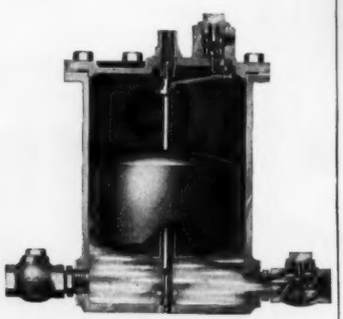
Differing from similar charts issued in the past, these Kellogg graphs are not only functions of temperature and pressure but are also a function of the composition of both the liquid and vapor phases. The charts cover pressures graduated from atmospheric to 1000 psia for any mixture of hydrocarbons from methane to n-heptane, including unsaturates. For higher pressures Kellogg has made available fugacity charts that go from 1,000 to 3,600 psia.

Instructions for use and sample calculations for bubble points, dew points and equilibrium flash points are included. The two volumes covering pressures from 14.7 to 1000 psia are available as a package for $20. An additional $10 will be charged for the volume of fugacity charts. For copies, write the Chemical Engineering Division, The M. W. Kellogg Co., 225 Broadway, New York 7, N. Y.

Buys Offshore Interest

Continental Oil Company has purchased a substantial interest in Magnolia Petroleum Company's operations in the Gulf of Mexico, off the coast of Louisiana. An interest in the same operations was also purchased by Newmont Oil Co., a subsidiary of Newmont Mining Company. The deal involves three gas well discoveries, extensive acreage and a number of undrilled properties. Five wells are drilling at the present time.

This patent



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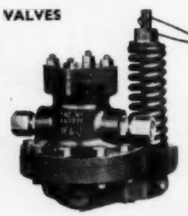

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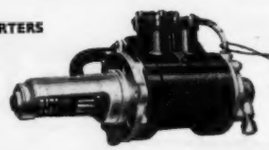

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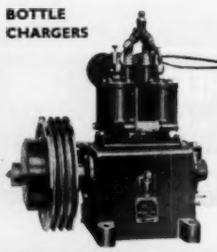

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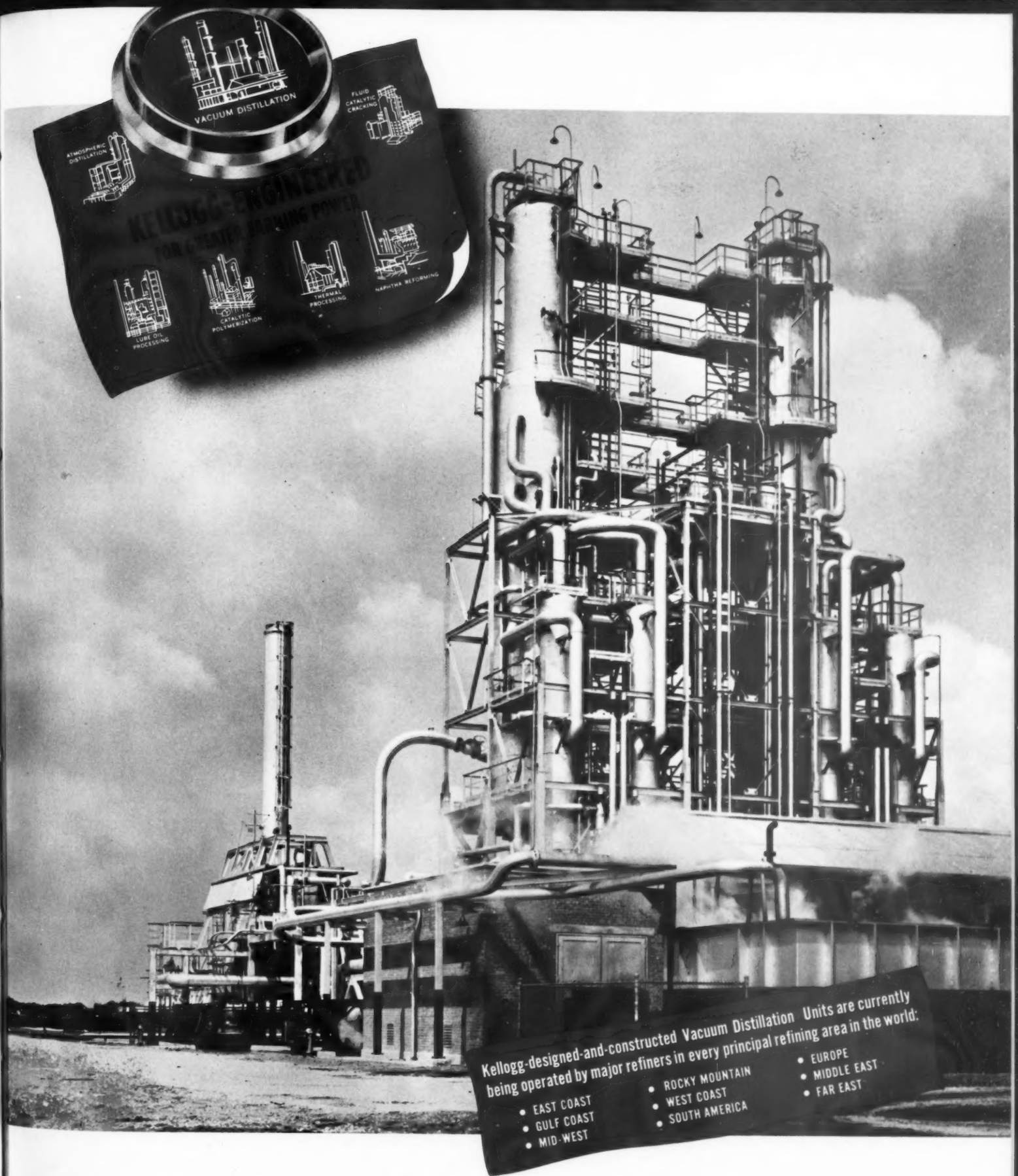

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Proper design of furnace, tower and internals and selection of heat transfer equipment are the real keys to high operating efficiency and low operating costs. This holds true whether you are aiming at lube stock production where viscosity index and accurate fractionation are the major requirements, or pointing toward cat cracker feed stock preparation for which the Conradson carbon of the overhead is the guiding premise, or even when designing a unit to perform both functions alternately. Most refiners are familiar with the study of "fluidynamics" of bubble towers carried on by Kellogg . . . but few, perhaps, know in detail the continuing, exhaustive study of the subject of heat exchange that Kellogg has carried on for more than twenty years. Comprehensive study of these two subjects within the same organization, combined with commercial operating data drawn from multiple sources, contribute in a major way to the improved earning power of Kellogg units.

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2 PROCESS ENGINEERING by three distinct groups of specialists—*sequence* engineers, *unit* engineers and *development* engineers—supported by an extensive reservoir of exclusive data.

3 SPECIALISTS IN EVERY PHASE of design engineering due to the completeness of Kellogg's engineering staff.

4. SPECIALIZED BUYERS backed by the cumulative buying power of the largest organization in the business . . . prove their value in dollar-and-cents savings for refiners. Kellogg buying groups match Kellogg engineering groups function by function, providing the closest possible integration between design and procurement. Complete knowledge of equipment available in the *world* markets and of facilities available for production of special equipment are the natural outcome of this specialization. Direct, constant liaison with engineering to produce detailed specifications promotes close competitive bidding both in domestic and foreign markets.

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6 CONSTRUCTION KNOW-HOW acquired in completing hundreds of major jobs, plus an ample supply of the proper tools, and the constant development of new money-and-time-saving methods on the construction lot.

7 PRACTICAL OPERATING COUNSEL on all design and construction, achieved through practical operating men working as an integral part of the company.

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Products Line in Venezuela

Creole Petroleum Corp. and Shell Caribbean Petroleum Co. are cooperating in the installation of an eight-inch products line from the seacoast at Catia la Mar to Caracas. The line will reduce delivery costs of refined products which are being used in greatly increased amounts in the Caracas region.

The new line will be used for the shipment of motor fuels, kerosene and diesel fuel. The pumping station at Catia la Mar will have a capacity of 5,400 barrels per hour. Combined tankage of the two companies at the marine terminal is about 335,000 barrels and at the delivery points at Caracas about 157,000 barrels. The line is expected to be in operation about next August.

Canadian Refinery Contract Awarded

British American Oil Co. Ltd. has awarded an engineering and construction contract to Canadian Kellogg Co. Ltd. for all processing equipment at a proposed plant in Edmonton, Alberta. The new refinery will have an annual capacity of two million barrels. It will include a combination crude oil distillation and thermal cracking unit, a coking unit, a fluid catalytic cracking unit and a complete chemical treating plant.

The new refinery will process crude from Redwater, which is to be brought to the refinery by pipeline. With the completion of this new refinery, British American will have three western refineries with a total capacity of 6,500,000 barrels per year operating on western Canadian crude.

Free Diesel Training Courses

Free training courses on diesel-powered trucks and buses are being offered by the Mack Truck Co., it is announced by H. W. Dodge, executive vice president. Mack is establishing these training courses in diesel truck and bus maintenance in more than 60 cities throughout the country. Eligible for free enrollment are truck owners, maintenance superintendents, shop foremen, garage or service station mechanics and persons employed in any capacity allied to the maintenance or operation of trucks and buses. Highly qualified diesel engineers and instructors staff the courses. Sessions run two hours one evening a week for ten weeks, with as many repeat terms as the number of applicants in any city warrant.

Cross-Scotland Pipeline Proposed

Grangemouth Town Council is currently considering proposals by the Anglo-Iranian Oil Co. Ltd. for the erection of a cross Scotland oil pipeline to feed the Grangemouth refinery. The proposal is understood to involve the creation of a crude oil handling depot at Finnart on Loch Long in the Clyde area, and this confirms earlier reports that such a depot was under contemplation. The pipeline is understood to cost a possible £2.5 million and would be part of the scheme now going forward at Grangemouth. If approval is given, the Council indicates, work would start in the near future. Among the issues involved is the fact that an area of some 50 yards around the pipeline would require to be sterilized for housing and other purposes. The Grangemouth authorities are to approach the oil company to suggest that the projected route through the town should be replanned so that the minimum interference will result with plans already prepared for housing estates to the east of the town where the incoming oil industry workers are to be housed.

The proposal to take a pipeline across Scotland, although not new, has now reached a stage where it raises a number of interesting points. One such is the potential reaction on Grangemouth, which presently handles a considerable volume of light tanker work. Assumption was that the Grangemouth development would mean an expansion of handling facilities on the Forth, and this must of necessity be the case, even if only for standby reasons. But operation of a cross country pipeline would result in an entirely different situation whereby the bulk of the oil involved might well be pumped from the Clyde to the refinery for reasons of transportation economy.

The prospect of any loss in traffic at Grangemouth is not welcomed by shipping officials who rather anticipated an expansion of traffic.

Royalty Debate

Consideration of the proposed new producing royalty rates in Persia are again being given by that country's parliament. Anglo-Iranian Oil Co. negotiated a revision of the present concession a year ago, but the contract has not yet been ratified. Under the proposed revision royalties would rise 50 percent to about 33 cents per barrel. At present Anglo-Iranian pays four shillings (gold) per long ton, an excise tax of nine pence, plus 20 percent of all earnings distributed to stockholders in excess of five percent. The new proposals would raise the royalty to six shillings per ton, excise tax to one shilling and profit sharing to 20 percent of all profits above five percent, whether distributed or placed in reserve.

Corrosion Prevention Brochure

Manchester Oil Refinery Ltd. has prepared a brochure describing a group of five coatings to prevent corrosion of equipment under various conditions of storage and use. The coatings are of various viscosities but each contains a corrosion inhibitor.

Leyland

Oil Transport

Leyland exhibits that will be displayed at **"The New York Show"** have been selected to indicate some of the more important types of vehicles made by the company. Not the least interesting will be a chassis specially developed for use in the oilfields.

In this field of oil transportation are Leyland trucks for medium-capacity and heavy-duty service, for bulk haulage, service station delivery, and special purpose machines for pipe-carrying and oilfield work.

All are powered by the famous Leyland direct injection diesels. In addition to road vehicles there will be a number of industrial power plant installations developed from these diesel engines.

See them at the British Automobile and Cycle Show, Grand Central Palace, New York — April

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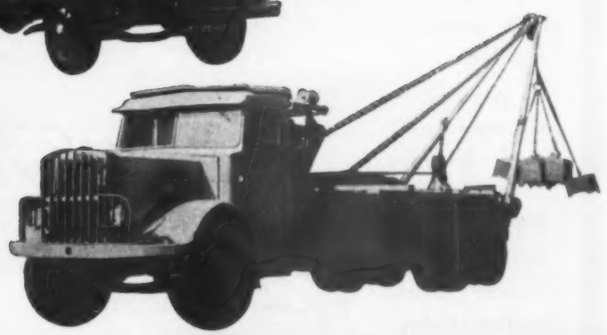

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Anti-Corrosion Paint System

Demonstration of a new anti-corrosion paint and a technique for applying it was made recently in the United States by Holger Boldemann and Sten Jeurling, director and chief technician respectively of Andros A.B., Swedish manufacturers. In the Antropahl system, as it is called, the paints employed are made of resins, oil and waxes. They contain no solvent and hence, when cold, form a tough, waxy mass. The paint is applied through a gun in which it is melted by electrical resistance and sprayed through a flame so that the mixture bonds immediately with the material to which it is applied.

Since the paints are melted by heat instead of being made liquid by solvents, it is possible to include raw materials which have high rust preventive qualities and which could not be dissolved by solvents. The advantages claimed for the system are long-term maintenance and a substantial reduction in labor cost.

Deep Test in Australia

As part of the Shell organization's search for oil in Australia, preparations have been completed for the drilling of a deep test, Morella No. 1, about 40 miles south of Rolleston in central Queensland. Some 1,000 tons of equipment are being moved to the site, and a 136-foot steel derrick has been erected. The total cost of the equipment and spares for the drilling operation is over £300,000. A camp for the housing of employees has been built and recreation facilities have been arranged.

Refinery for Manitoba

Definite confirmation has been given by Imperial Oil Ltd. of its decision to build a refinery at Winnipeg, Canada. It is stated that construction will begin shortly on a site of 400 acres, seven miles north of Winnipeg on the Red River. Capacity of the refinery will be about 10,000 barrels daily, and the cost will be around $10 million. It is expected that construction will be completed in May 1951.

The plant is designed particularly to serve the needs of consumers in Manitoba. It will manufacture the usual line of petroleum fuels, including gasoline kerosene, diesel and furnace oils and heavy residuals. Its crude supply will come from Alberta fields and will be delivered by rail or branch pipeline from a take-off point on the Interprovincial pipeline at Gretna, Manitoba.

The refinery will include a combination atmospheric and vacuum pipe still with a capacity of about 10,000 barrels daily, a fluid catalytic cracking unit of 3,000 barrels daily, treating facilities for gasoline and distillate fuels and a light ends recovery plant. In addition there will be the necessary steam generating units, water pumping facilities, office and laboratory buildings and machine shop.

American Cyanamid Report

Sales and earnings of American Cyanamid Company, prominent manufacturer of chemicals, for the year 1949 were the largest in the corporation's history, according to its annual report. Net sales amounted to $237,730,665 of which approximately 17 percent were to customers outside the United States. Consolidated net earnings of the company and its subsidiaries were $16,149,153 as compared with $11,875,090 in 1948. Expenditures for plant investment during 1949 were $13,111,286, bringing capital expenditures for added facilities during the past five years up to $102,754,871.

THOMAS S. JOHNSTON, veteran of 20 years' experience in the oil transportation business, has been appointed vice president in charge of transportation for Interprovincial Pipe Line Co., Toronto. He became associated with Imperial Oil Ltd. in 1945.

Japan Refinery On Steam

Preliminary operations at Toa Nenryo's Shimizu refinery southwest of Yokohama have started and the plant will soon be on stream at the rate of 4,000 barrels a day. H. M. Davidson, manager of Standard-Vacuum Oil Company's manufacturing department left New York recently for Tokyo to inspect the recently re-built facilities at Shimizu and to confer with officials of the Japanese company which owns the plant. Standard-Vacuum purchased an interest in Toa Nenryo Kogyo, Ltd., several months ago with the approval of the occupation authorities and the Japanese Government. Toa Nenryo also owns the Wakayama refinery, now being reconstructed and which is expected to start operating early in April at the rate of 6,000 barrels a day.

Up to the present time Japan's post-war petroleum requirements have been met largely with imported products which SCAP has paid for with U. S. funds. In line with General Douglas MacArthur's efforts to reduce this burden on U. S. taxpayers, authorization was given several months ago permitting Japanese refineries to prepare to resume the processing of imported crude oil. A saving of $25,000 per day is expected to result. To further facilitate SCAP's program, foreign capital now is permitted to invest in Japan.

The first post-war shipment of imported crude bought by the Armed Services Petroleum Purchasing Agency reached Japan from California in February, enabling the approved refineries to start up. Additional supplies of crude from U. S. sources covering the first quarter of the year have been contracted for. Some crude from sterling sources in North Borneo and Kuwait is also being imported.

While Standard-Vacuum has been a distributor in the Japanese market since 1890, its acquisition of an interest in Toa Nenryo marks the first time it has participated in refining operations in that country.

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On this well, drill stem tests from the Simpson recovered several thousand feet of water contaminated by salt and sulphur compound, and the clay-water mud became badly contaminated, resulting in a very high water loss. This mud was treated with alkalizing agents and Impermex over a 12-hour period.

	Contaminated Mud	Same, after treatment
Weight	10.0 lbs. per gal. (75.5 lbs.cu.ft.)	10.0 lbs. per gal. (75.5 lbs.cu.ft.)
Viscosity	50 sec. API	43 sec. API
Water Loss	52 cc API	1.8 cc API
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Cake Thickness	. . . .	1/32" API
pH	7.9	12.5

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Esso New York Launched

The Esso New York, the eleventh of 12 Esso supertankers, was launched Feb. 9 at the Newport News Shipbuilding and Dry Dock Co., Newport News, Va. The new tanker has a capacity of 230,000 barrels, a service speed of about 16 knots and a deadweight of 26,800 tons. Like her sister ships, the tanker is 628 feet overall length and has 82 feet six inches of molded beam, 42 feet six inches of molded depth to the upper deck, and 31 feet 11 and a quarter inches draft. Each ship has a single screw driven by a high-pressure geared steam turbine capable of developing 12,500 shaft horsepower at 112 revolutions a minute. With the completion of the twelfth supertanker, the Esso ocean-going world-wide fleet will number 120, ships of about 2,062,000 deadweight tons, it was announced.

Flow Meter Engineering

"Principles and Practice of Flow Meter Engineering" by L. K. Spink, published by The Foxboro Co., Foxboro, Mass.; price $7.00.

This is the seventh edition of this handbook first published in 1930. Much new material has been added. All the necessary information is given for calculating an orifice, flow nozzle, Venturi tube, Pitot tube or even a pipe elbow used for flow measurement. Equations and curves for calculating throttling orifices to be used at critical pressure drops are a new addition to the book. Other new features include a complete section on measurements of fluid flow in metric units, a table of corrections for barometric pressures, a table of pressure multipliers up to 5000 psig, a description of practical methods of applying AGA Gas Measurement Committee Report No. 2, new and simplified instructions for use of the square-root planimeter on gas meter charts, and pages of examples of typical calculations in flow meter engineering.

To Extend Products Line

Award of two contracts for construction of an oil products pipeline from Boise, Idaho, to Pasco, Washington, has been announced by C. E. Finney Jr., president of the Salt Lake Pipe Line Co. Morrison-Knudsen Company Inc., Macco Corporation and Bechtel Corp. will build the section from Boise to Baker, Oregon. The northern portion of the line from Baker to Pasco will be built by Pacific Pipeline and Engineers Ltd.

The installation will be a 240-mile extension of the Salt Lake-Boise line begun last year by the Salt Lake Pipe Line Co., a Standard Oil Co. of Calif. subsidiary, to transport oil products to the northwest area from a refinery at Salt Lake City. The first leg to Twin Falls was opened to service early in January. The Boise-Pasco section will serve Standard's bulk distributing plants at Ontario, Pendleton and Baker in Oregon. Cost of the project will be approximately $13,500,000.

West Texas Geophysicists Organize

The Society of Exploration Geophysicists, Tulsa, has received a petition for affiliation from the Permian Basin Geophysical Society of Midland, Texas. Approval of the petition would establish the Permian Basin section as the seventh local group of geophysicists to become a part of the SEG. Other sections are now located in Tulsa, Dallas, Houston, Shreveport, Fort Worth and Los Angeles. Groups are also being organized in Calgary, Alberta, Canada, Denver and San Antonio.

Refinery Safety Manual

"Safety in the Petroleum Refining and Related Industries" has been published by John G. Simmonds & Co. Inc., New York insurance underwriters. The publication comprises approximately 425 pages containing 238 photographs, charts, flow diagrams and other illustrations. It was prepared by George Armistead Jr., consulting engineer of Washington, D. C., who has been associated with refinery safety work and prepared one of the first widely distributed safety inspection manuals for Gasoline Products Co. Inc. in 1938. Copies are available at $10 to companies not customers of the Simmonds organization.

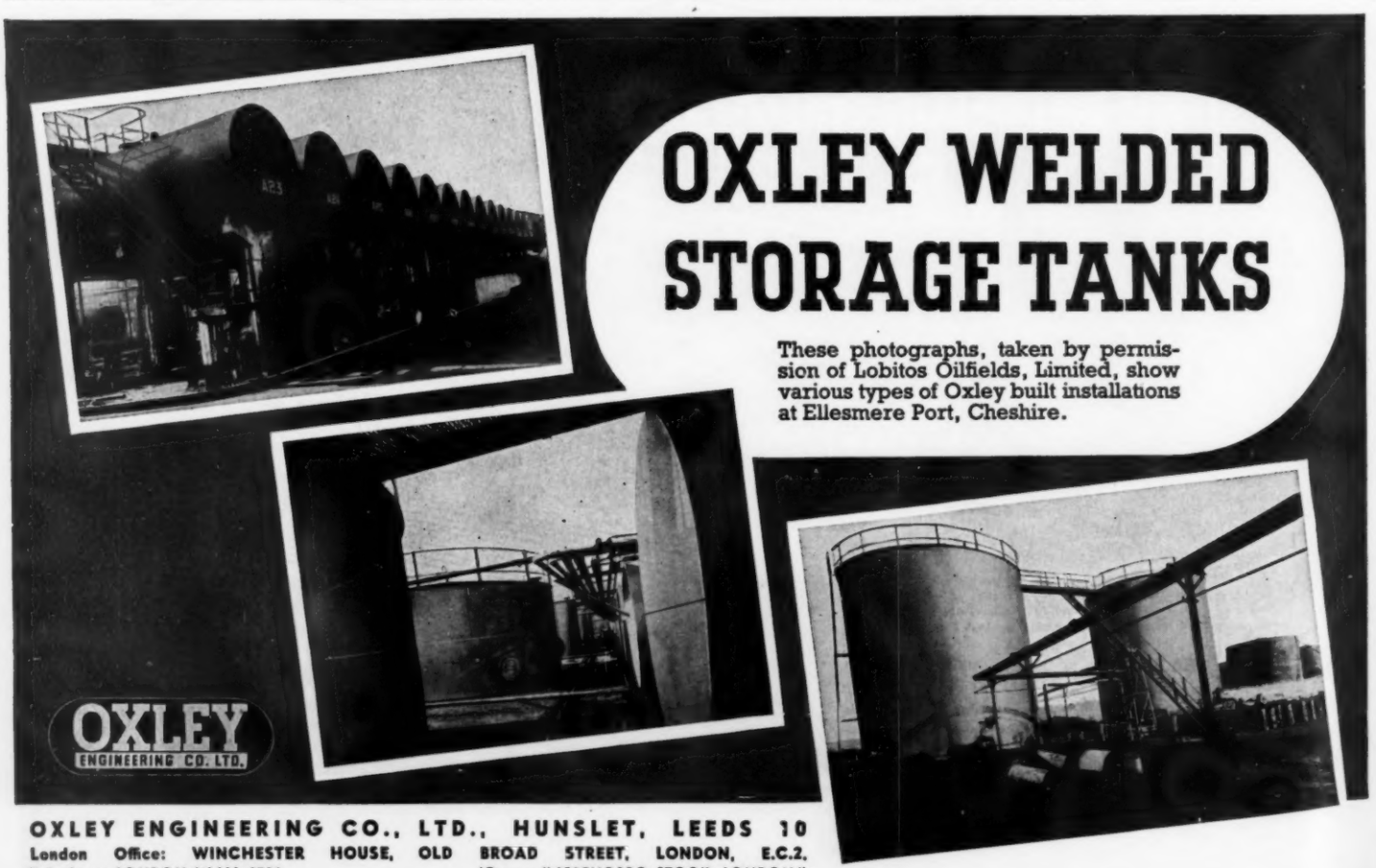
Improves Marine Terminal

An extensive rebuilding program to enable two of the largest tankers afloat to dock and load with crude oil at the same time is under way at Humble Pipe Line Company's Harbor Island terminal on the Corpus Christi ship channel. The terminal's present wooden wharves will be replaced with larger steel wharves, and the berthing area will be dredged to a greater depth and width, and a new barge slip will be constructed.

The new wharves will be 300 feet long (including breasting clusters) and 27 feet wide and will accommodate two 720-foot tankers at the same time. Also it will be possible to load or unload a tow of three barges at the same time in the new barge slip, 110 feet wide and 390 feet long.

Safe Handling of Radioactive Isotopes

Recommendations for the safe handling of artificially-produced radioactive isotopes in the typical laboratory or small industrial operation are concisely set forth in a new handbook, H42, Safe Handling of Radioactive Isotopes, issued by the National Bureau of Standards and available from the Government Printing Office. The 29-page booklet is sold at 15 cents a copy by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Remittances from foreign countries should be in United States exchange and should be an additional sum of one-third the publication price to cover the cost of mailing.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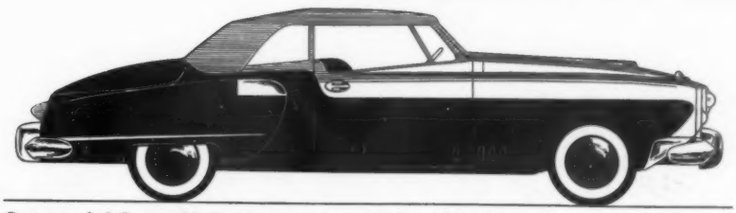

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PROTEIN FROM PETROLEUM

By Dr. O. W. Willcox

IT IS an accepted fact that crude petroleum is a source of hydrocarbons so rich and varied that the chemists can find in it the foundation materials for synthesizing nearly any kind of organic material they might care to make. To this statement an apparent exception might be made; while the petrochemists would have little or no difficulty in synthesizing the amino acids and other "building stones" out of which plants and animals fabricate protein, they have up to now found no direct chemical method to put these molecular building stones together for producing synthetic protein. Lacking such a direct chemical method, the world must apparently continue to depend on the vegetable kingdom for this indispensable element of its food.

But the fact is that the vegetable kingdom is not delivering enough protein to a hungry world. Production of protein is, in fact, the bottleneck of the global food problem, and the world, not excepting the United States, will never be satisfactorily fed until enough protein is produced for everybody. Various indirect methods for increasing the supply of protein are known and have begun to be used, but all these methods still depend on the transformation of non-protein vegetable products such as the sugars. For his daily intake of protein, man is still bound to the soil.

To these indirect methods depending on the soil the petrochemist is (and unknowingly has been for a long time) in a position to make an important if not a decisive contribution that does not depend on the soil.

The synthesis of alcohol from ethylene is an old routine that has been known to the organic chemists for 100 years, and today nearly three-fourths of all the industrial alcohol used in the United States is produced from ethylene, a by-product of petroleum refining. Alcohol from this source is much less expensive than alcohol from grain and other farm products, and alcohol from the oil refineries is driving even the cheapest of alternate sources—sugar cane molasses—out of this field. Expansion of the production of alcohol synthesized from ethylene awaits only the occurrence of additional outlets for the product. One such outlet that now appears on the horizon is the conversion of alcohol into protein.

The conversion of alcohol into protein is also an old story, but somehow its significance has been overlooked until quite recently. The basic facts of the matter are as follows:

The production of alcohol from grain or molasses is intimately associated with the production of baker's yeast from the same materials. Yeast and alcohol are in fact produced in the same operation, but the proportions of the two products depend on how the operation is managed. If the purpose is to produce the largest possible yield of alcohol, the grain or molasses is fermented in tubs in which the presence of air is restricted to a small minimum. Under this circumstance the yeast can use, for the purposes of its own growth and development, only a small part of the fermentable sugars at its disposal, and is obliged to turn a large part of the remaining sugar into alcohol which it is unable to consume for lack of air.

On the other hand, if it is desired to produce the largest possible quantity of yeast, the operator arranges to blow large volumes of air through the fermenting mass; under this circumstance, with plenty of air, the yeast consumes the alcohol as fast as it is produced and uses it to make new cells in large numbers. It then results that the operation yields a large quantity of yeast but no recoverable alcohol.

Now, yeast is one of the richest of proteinous foods; half of its dry weight is pure protein, which also carries essential vitamins in abundance. It is a good food for man and his farm animals.

The inference is plain: given an abundant and cheap source of alcohol, the world's supply of protein could to a large extent be freed from dependence on the soil.

As stated, the fact that yeast can use alcohol for the multiplication of its cells has long been known to the fermentologists who, until quite recently, have not seen the bearing of this fact on the world's food problem. Recognition of the possibilities came about in this way:

During the German occupation the matter of providing the Belgian population with protein food became critical; the value of yeast as a protein food was well known, and a national commission was created to produce it. Immediately the question of raw material arose. Grain, molasses and other fermentable substances were scarce, and all available supplies of these materials were being directly consumed as carbohydrate food. Then it was recalled that yeast can use alcohol for the multiplication of its cells, but there was no surplus of farm products for conversion into yeast or alcohol. At this juncture someone thought of the old, well-known chemical reaction in which ethylene is absorbed in sulfuric acid, from which alcohol is then produced. But no oil refineries were in operation from which ethylene could be procured. However, a few coke ovens were still going, and from the gases of these ovens enough ethylene could be had for pilot plant purposes.

After that the process was easy and successful. With a small quantity of mineral salts for the yeast, such as ammonia, phosphate or sulfur, and with alcohol made from ethylene as the only organic raw material, food yeast was prepared by the same process as employed in a regular yeast factory, using vigorous aeration. And the yield was good, amounting up to 75 per cent of the weight of the alcohol. Moreover, the operators of this new kind of yeast factory found ways of producing food yeast of a much better quality than ordinary.

The value of this rediscovery of an old fact to the petroleum industry may not be as remote as some might think. Outside the United States the world's need for more protein in its daily food is great. Even in this relatively well-fed country there is a market for food-yeast products on account of their great richness in the vitamins that sustain life and maintain health. This market seems to be capable of considerable expansion, especially if recent ideas are put to use for turning out an improved product. Besides its use as a human food, byproduct yeast from the fermentation industry — breweries and whiskey factories, for example — is in good demand as a stockfeed. Dairy farmers in Wisconsin pay up to $30 to $50 and on occasion up to $100 a ton for alfalfa hay that contains less than half as much protein as yeast. The development departments of oil companies having an excess of ethylene-alcohol capacity might look into this. In the future the yeast factory as an adjunct of an oil refinery might not be such an anomaly as it may now appear.

For that matter the petroleum industry already has a toehold in the food business. There is now a Gulf Coast factory that is turning out thousands of tons of glycerine a year. This glycerine is not being consumed as food, but it could be as it belongs to the class of digestible materials similar to carbohydrates. Recent developments in petrochemistry have made it possible to combine glycerine with synthetic fatty acids, also produced from petroleum, to give edible fats. And now, with protein added to its list, the petroleum industry is in a position to offer the basic elements of a complete diet—protein, carbohydrate material and fats with plenty of vitamins.

These developments in petrochemistry are cumulative reasons for optimism in the matter of the world's ability to feed itself in the face of a snowballing increase of world population. Agrobiologic science still has large unused resources for food production; and now back of the agrobiologists stand the petrochemists equipped and ready to produce ethylene, alcohol and protein from the vast existing reserves of crude oil, oil shale and coal. With all these the world need never, or at least not for an incalculably long time, go or remain on short protein rations. The know-how and the basic natural resources are at hand; the rest is a matter of economics.

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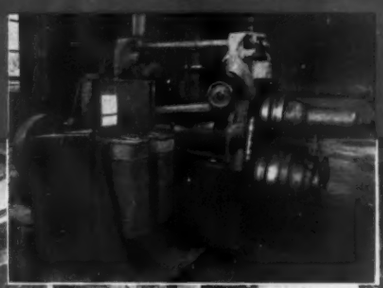

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New Book

Petroleum Refining, edited by Harry M. Crain, published 1950 by Colorado School of Mines, Golden, Col.; 162 pages with 82 illustrations, 24 tables; $2.00.

This book is No. 2A of the Quarterly Journal of the Colorado School of Mines and was compiled in celebration of the seventy-fifth anniversary of that well-known mining school. The present work comprises six papers on petroleum refining that were presented as part of the celebration. The titles of the papers and their authors are: "The Cracking of Petroleum" by Edward W. Isom, vice president, Sinclair Refining Co., New York City; "The Commercial Dehydrogenation of Normal Butane" by Harrison L. Hays, superintendent of operations, and Edward Dolezal, mechanical consultant, Phillips Chemical Co., Bartlesville, Okla.; "Ethylene Production by Thermal Cracking of Propane-Ethane Mixtures" by C. K. Buell, manager, chemical engineering department, and L. J. Weber, Phillips Petroleum Co., Bartlesville; "Petroleum Refining Instrumentation" by H. M. Schmitt, manager, chemical industry division, Minneapolis-Honeywell Regulator Co., Brown Instruments Division, Philadelphia, Pa.; "Research in the Petroleum Industry—Today and Tomorrow" by C. K. Viland, general supervisor, research and development department, Tide Water Associated Oil Co., Martinez, Calif.; and "Low-Temperature Distillation Assays of Representative Western U. S. and Alaska Coals" by V. F. Parry, supervising engineer, J. B. Goodman, chemical engineer, and Manuel Gomez, chemist, Subbituminous and Rocky Mountain Coals Section, United States Bureau of Mines, Golden, Col. All six papers are noteworthy contributions.

Drill Collars

A new type of drill collar with replaceable ends, designed to minimize the problem of joint failures, has been developed by the Spang-Chalfant division of National Supply Company. The drill collar has wear subs more or less permanently affixed at both ends. Whenever a taper joint failure occurs, or the outside diameter has been reduced enough to warrant replacement, any end can be removed and replaced with a spare end on the rig without any special equipment or supervision. The failed sub and possibly the mating sub, if damaged, may be sent to the shop for cutback and rethreading without shortening the collar string or delaying drilling operations. The reconditioned subs are returned later to stock as spares.

Revised Product Book

A revised edition of "Products and Services of American Cyanamid Co. for Industry and Agriculture" has just been published. This 64-page illustrated book describes Cyanamid products and services and outlines the divisional structure through which such products are sold. Copies are available upon written request to the American Cyanamid Co., 30 Rockefeller Plaza, New York 20, New York.

Spanish-English Dictionary

Engineers' Dictionary, Spanish-English and English-Spanish, by Louis A. Robb; second edition, published 1949 by John Wiley & Sons, Inc., New York; 664 pages; $12.50.

This dictionary can be recommended as a very useful aid in English-Spanish and Spanish-English correspondence, especially in matters of engineering and machinery. Within its limits the compiler has given ample attention to electricity, mechanics, radio, television, civil engineering, photography, airports, mining, naval architecture, machine parts and even well established trade names. Much attention has been given to oil field terminology and to the sugar industry. As a good technical dictionary should, it defines many compound phrases, the meaning of which cannot be represented by single words.

New Inhibitor

A new inhibitor for sulfide corrosion in producing oil wells has been developed by Humble Oil & Refining Co. and will soon be placed on the market under the trade name of "Corexit." Field trials of various inhibitors were made for several years in sour crude areas of west Texas in developing the new product.

Off-Shore Oil Prospects

The new Oceanography and Meteorology Division of the Southwest Research Institute, San Antonio, has issued its first bulletin, consisting of a bibliography of papers, publications and books on off-shore petroleum developments. More than 250 items are cited relating to developments in the Gulf of Mexico, Lake Maracaibo, off the California coast and other marine areas.

To Double Poly Unit Capacity

Catalytic Construction Co. has been awarded a contract by Sun Oil Co. to double the capacity of the catalytic polymerization unit at the Toledo, Ohio, refinery. The existing equipment, constructed in 1940, consisted of 24 reactors with a reserve structure area for the 24 cases to be added under the new contract. The 48 cases will have a capacity of 5,000 barrels per day of mixed butanes butylenes charge. Refinery expansion in the Toledo plant includes a quadruple reactor Houdriflow unit with a capacity of 28,000 barrels per day.

Offshore Film Available

"Neptune's Oil Fields," a 27-minute sound and color motion picture of offshore drilling, just completed by Kerr-McGee Oil Industries Inc., is now available for showing to oil and gas groups, civic clubs, engineering and geological societies and college classes. Applications for free showing should be sent to Kerr-McGee office in Oklahoma City.

Welding Slide Rule

A new pocket-sized G-E welding electrode comparator slide rule chart (Publication No. GEN-37) has been announced as available from the General Electric Company, Schenectady 5, N. Y. This comparator slide rule lists all of G.E.'s welding rods and electrodes and indicates the type of service for which each is designed. All principal manufacturers' electrodes which are the closest equivalents for the application noted for G.E.'s rod are also listed. Listings are suitably keyed to AWS classification numbers, and comparison data may be read directly off the slide rule.

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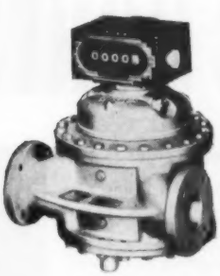

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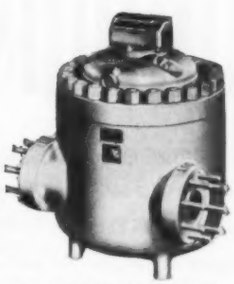

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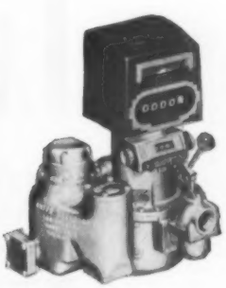

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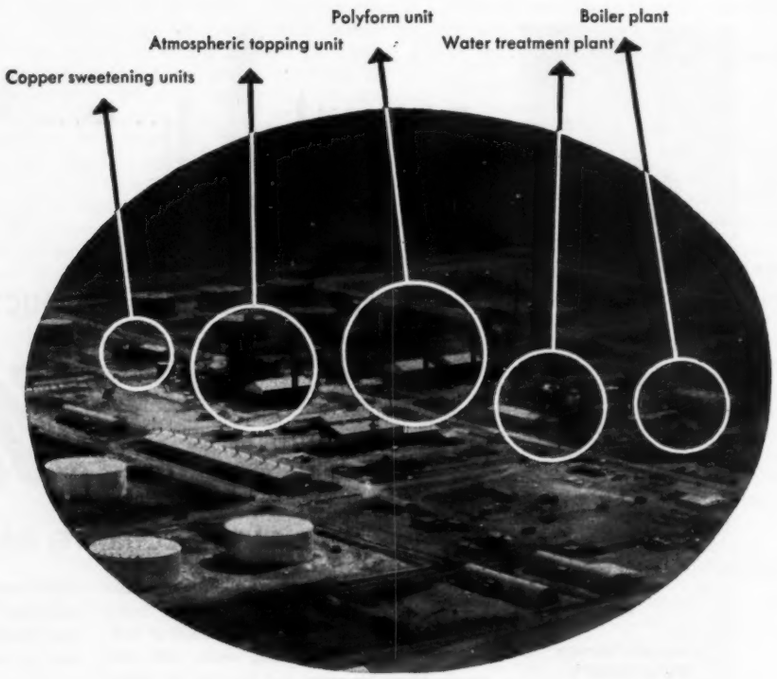
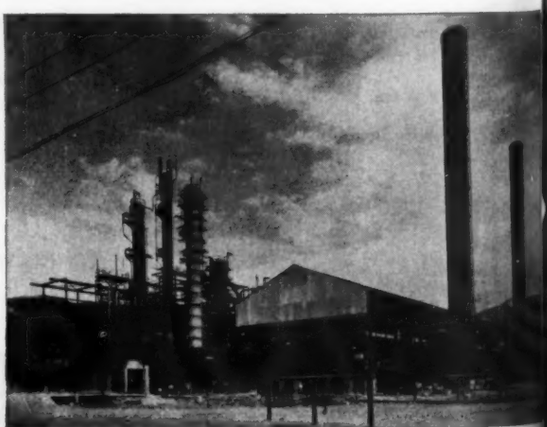


Lummus beats deadline at P

Currently going "on stream" is this completed and fully integrated 40,000 B/D Refinery. Clearing and grading at plant site was begun in February 1949. Once under way, the commitments of the planned work schedule were fulfilled before due date, with a significant time saving on the completed job.

The refinery is to produce motor fuel, diesel fuel, bunker C oil and liquid propane from Orinoco River crude. Major units in the project, as shown on this page, include: (1) atmospheric topping unit and desalting unit, (2) naphtha-gas oil polyform unit of 32,000 B/D capacity, (3) two 10,000 B/D copper sweetening units, and complete water treatment and power supply facilities.

Wherever it may be—completion of plants well in advance of schedule, reflects the thorough planning and sound construction experience which Lummus will bring to your next project.



Naphtha-gas oil polyform unit. The gas oil is cracked once-through in the presence of propanes and butanes in a Lummus heater. Naphtha with propanes—butanes is cracked in the same furnace.

A complete water treatment plant of 3,500 GPM capacity is an essential part of the project. River water is filtered, chlorinated and treated for boilers, cooling and domestic use.

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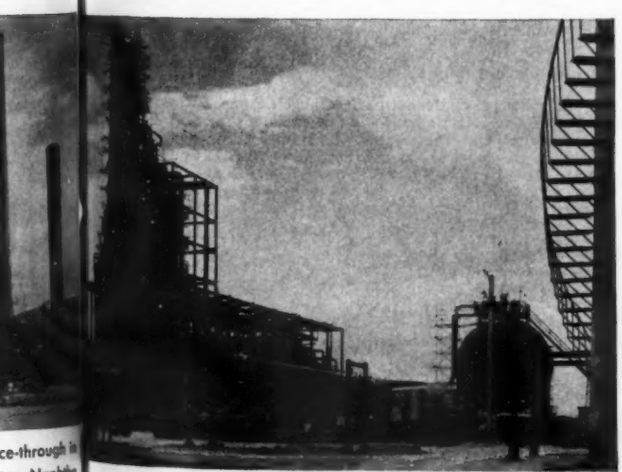

Atmospheric topping unit, with 34-foot settling sphere of desalting unit at right. The gas recovery system consists of a compression recontacting operation followed by depropanization. The topping unit is equipped with a single down-draft Lummus furnace.

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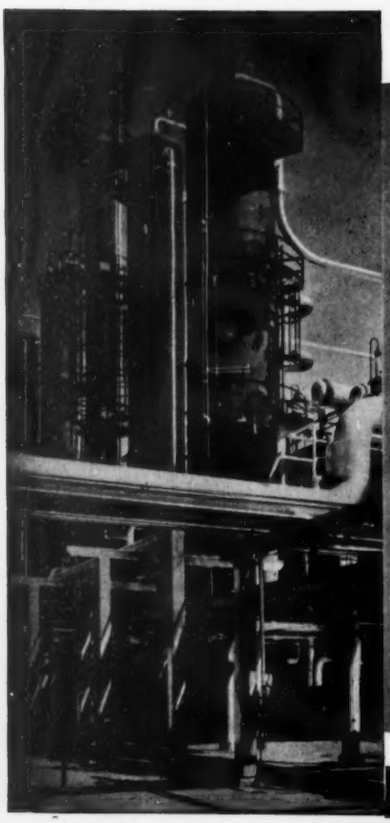

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NEW CATALYTIC REFORMER PRODUCES 82-OCTANE FUEL FROM MICHIGAN NAPHTHA

(Continued from Page 33)

rator is mixed with light straight-run gasoline and stabilized to 10#RVP in a 24-plate column. Overhead from the stabilizer is mixed with excess hydrogen and used as fuel. The unit is self-supporting as far as fuel is concerned.

In early operation of the unit, some sulfide corrosion appeared, but this was overcome by ammonia injection in the prefractionator.

Dr. Haensel told the WPRA that studies have been made to determine whether Platforming will be beneficial in upgrading of thermally-cracked gasoline. It was found that thermally-cracked stocks are very susceptible to Platforming and very high octane number fuels have been produced. Sulfur content of stocks such as west Texas, running as high as 0.49 percent, have been cut to 0.0045 percent and below. Octane ratings have been increased from 60 to 89 F-1 clear and from 71.8 to 98 with 3cc of TEL.

In connection with thermal cracking it was found that the best final results were obtained by Platforming the higher boiling fractions and eliminating the fraction boiling below 200° F from the charge to the Platforming unit. In order to produce an adequate supply of hydrogen, it is desirable to blend straight-run naphthas with the olefin-containing stocks in equal quantities as charge stock.

Investigations were conducted of the properties of the blend of the Platformed cracked naphtha with the untreated lower boiling fraction of the cracked gasoline. It was found upon comparing the road performance of this blend with the road performance of the original full-boiling range thermal gasoline that the material containing the Platformed fraction was superior to the thermal gasoline by a margin exceeding 15 octane numbers.

In his WPRA paper Dr. Haensel also said that the effect of operating variables is such that the refiner can produce a number of volatility-octane relationships. The process thus may be modified to fit in with overall refinery economics. At Old Dutch the operation has been changed a number of times in the first four months to meet market conditions. Original plan was to produce a material with a leaded octane of 88-90, but at one time it was operated for several weeks to produce a 95.8-octane product with a 90-percent yield. More recently it has been operated to produce a leaded octane number of 93 with a yield of 94.5 volume percent.

Decline in U. S. Imports

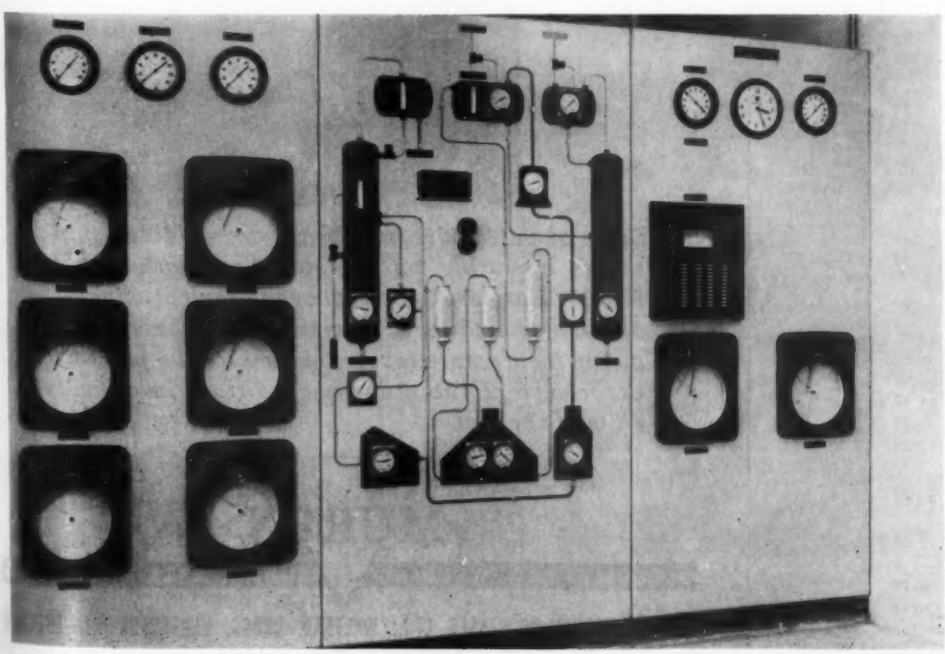
Crude oil imports to the United States during February were about 90,000 barrels per day less than the volumes for January, according to preliminary estimates. January total imports were roundly 890,000 barrels daily. Calculations from API figures on foreign crude runs and crude stocks levels show total crude oil imports in February came to 440,000 as a daily average. This compares with 533,000 in January.

Exact figures of product imports are not yet available, but there is a probability that fuel oil receipts were higher in February than the preceding month due to the coal strike and colder weather.

Shell Research Budget

The Royal Dutch-Shell has budgetted £6,500,000 ($18 million) for research during 1950. It is stated that 3,500 employees are engaged in work in the research laboratories maintained by the Group in the United States, the United Kingdom and the Netherlands.

Old Dutch Platforming unit instrument board.



© Fabian Bachrach

James F. Thornton

Thornton Elected President of Lummus

James F. Thornton has been elected president of The Lummus Co., New York, refinery engineers and contractors. He succeeds Carl S. Reed, who has been elected chairman. Mr. Reed has been president of Lummus since the company first was organized in 1930.

Mr. Thornton joined Lummus as process design engineer in 1934, a year following his graduation from Yale School of Engineering. Before the war he spent a number of years in Europe where Lummus has subsidiary organizations in both England and France. He has made many overseas trips since then. From 1942 to 1945 he was manager of the Los Angeles office for The Lummus Co.

In 1945 Mr. Thornton returned to the company's New York headquarters as assistant to President Reed. He was executive vice president at the time of his recent elevation to the presidency.

Saudi Arabia's Production

Crude oil production in Saudi Arabia during February amounted to 13,900,285 barrels, an average of 496,439 barrels per calendar day. Production for the first two months of 1950 amounted to 27,848,215 barrels, an average of 472,004 barrels per calendar day. Crude run in the refinery for the same period was 6,304,724 barrels, an average of 106,860 barrels per calendar day.

British Columbia Drilling

Phillips Petroleum Co. is down to approximately 4,500 feet in its Lone Mountain No. 1 in the Peace River district. For access to this site Phillips built about 50 miles of road last fall. A second Phillips well, Sunset Prairie No. 1, also in the Peace River district, is still drilling with a depth of 1,668 feet on Feb. 15.

Peace River Natural Gas Co. Ltd. discontinued its test well No. 8 in the Peace River district when it reached the limit of the rig. A report from the office of the petroleum controller says: "Cased from 8-inch to 5,895 feet. Intend to reopen with heavier rig."

Britalta Petroleums Ltd. and Royalite Oil have plugged and abandoned Royalite Queen Charlotte No. 1 on Graham Island in the Queen Charlotte Islands. Equipment is still on the island and another test may be sunk when the weather improves.

Erratum

On page 62 of the March issue Qatar production was increased rather unduly because of a wandering decimal point. The title should have read, "Qatar to Add 15 Million Barrels to Middle East Production in 1950," instead of 150 million barrels, and the same error was repeated in the text. Excuse it, please.

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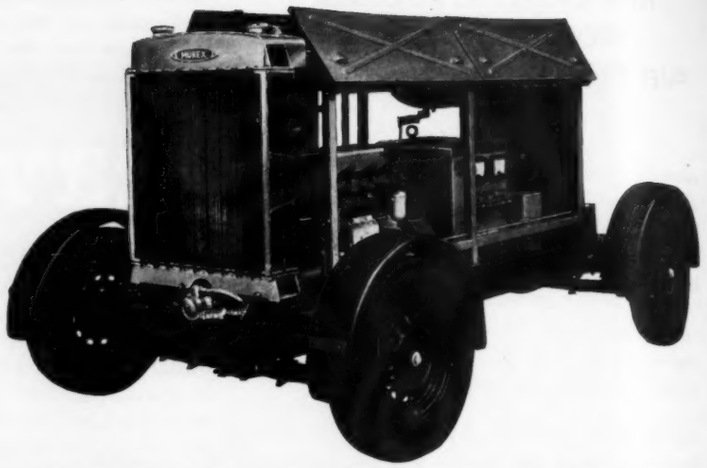

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There's an ALLOY metal story inside This REFINERY TOWER

The 10-ft. diam. by 110-ft. tower in the accompanying view is a crude fractionator for a refinery in Argentina. It will be subject to corrosive service at fairly high operating temperatures.

The story of its construction covers two important points—the *kinds* of alloy metals used and the *way* in which they were applied. The kinds of metals specified are as follows:

Stainless Steel—11-13 per cent chrome type 410 lining for lower 60 ft. of tower, bottom head, and for nozzles in lower 79 ft. 6 in. of tower. (Above the 60 ft. level, the shell is constructed of plain carbon steel without a lining.)

Monel—lining for nozzles in the tower above the 79 ft. 6 in level.

The lining on the inside of the shell was applied as follows:

Shell—35⅝-inch wide strips automatically welded with type 310 25-20 alloy rod.

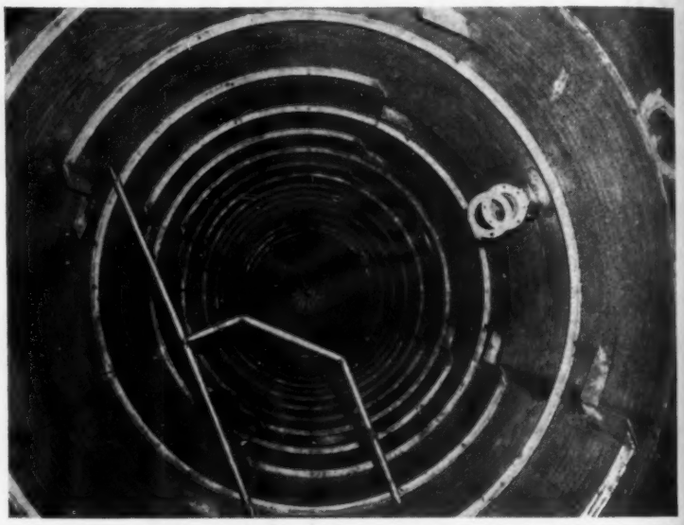
Bottom—4-inch wide strips welded by hand with 25-12 alloy rod.

To complete the job, the heads were stress-relieved after forming and the entire vessel was random x-rayed.

It's evident that in the building of this or any other tower alloy metals must be applied correctly before the tower can function efficiently. Our long experience as fabricators of refinery equipment —and the fact that we are working with alloy metals constantly in our shops—are your assurance that we apply alloys *correctly*.

Refinery towers are only one of many kinds of steel plate structures we build for the petroleum industry. Others include flat-bottom storage tanks, Hortonspheres, Hortonspheroids, and Horton Floating Roofs. Write our nearest office for quotations or information.

This view shows two sections of a 10-ft. diam. by 110-ft. fractionator tower being fitted together at our Birmingham plant. Lining of the shell with strips of stainless steel has already been completed.



An inside view of the nearly-completed tower showing the shell lining and the bubble tray support rings. The stainless steel lining in the base of the tower can also be seen.

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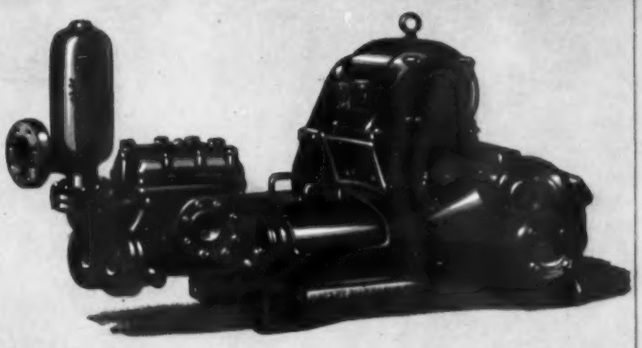
for the Oil Industry



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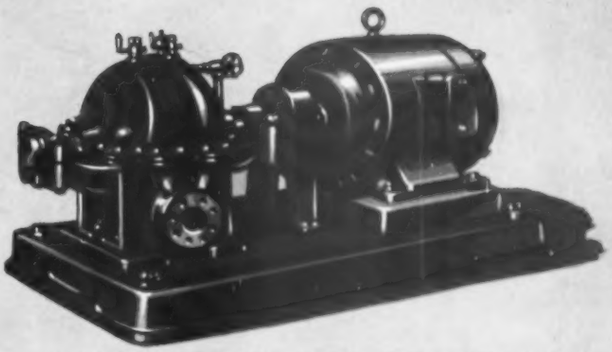
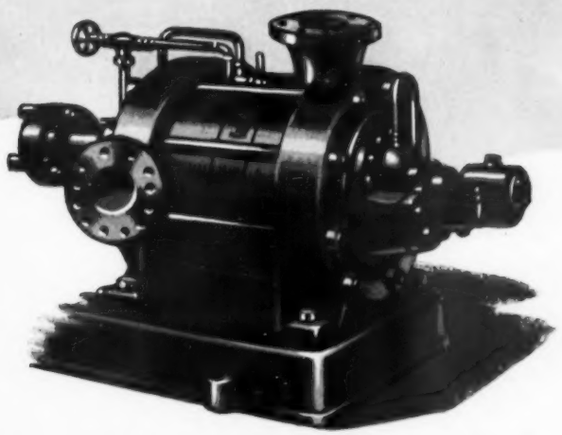
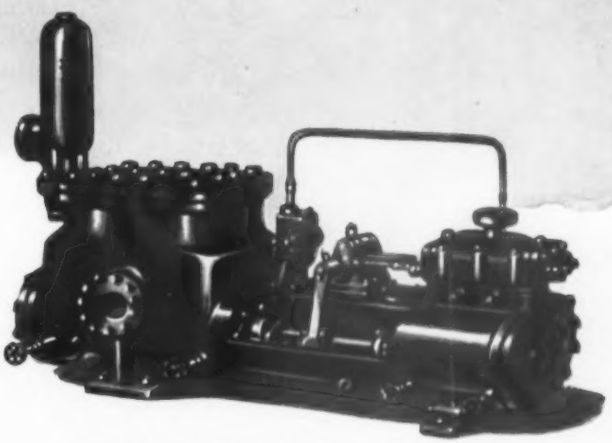


2 STAGE MEDIUM LIFT VOLUTE TYPE PUMP. Made in sizes from 2" to 6" delivery branch for heads up to 250 ft. Normally supplied with cast iron casing and bronze internal parts but special materials can be supplied if desired. For direct or belt drive.



MULTI-STAGE MOTOR DRIVEN PUMPS made in a range of sizes up to 6" diameter delivery branch, with from one to ten stages, suitable for heads up to 1000 ft. Cast iron casings and bronze internal parts. Can be supplied for higher pressures with cast steel casings.



A typical Evans **DUPLEX STEAM PUMP.** Built for extreme service. Can be fitted with removable liners of material to suit all requirements and valve service to suit varying liquids. Simplex steam pumps and steam jacketed pumps on similar lines are also made in a range of sizes.

Joseph Evans
& SONS (WOLVERHAMPTON) LTD.

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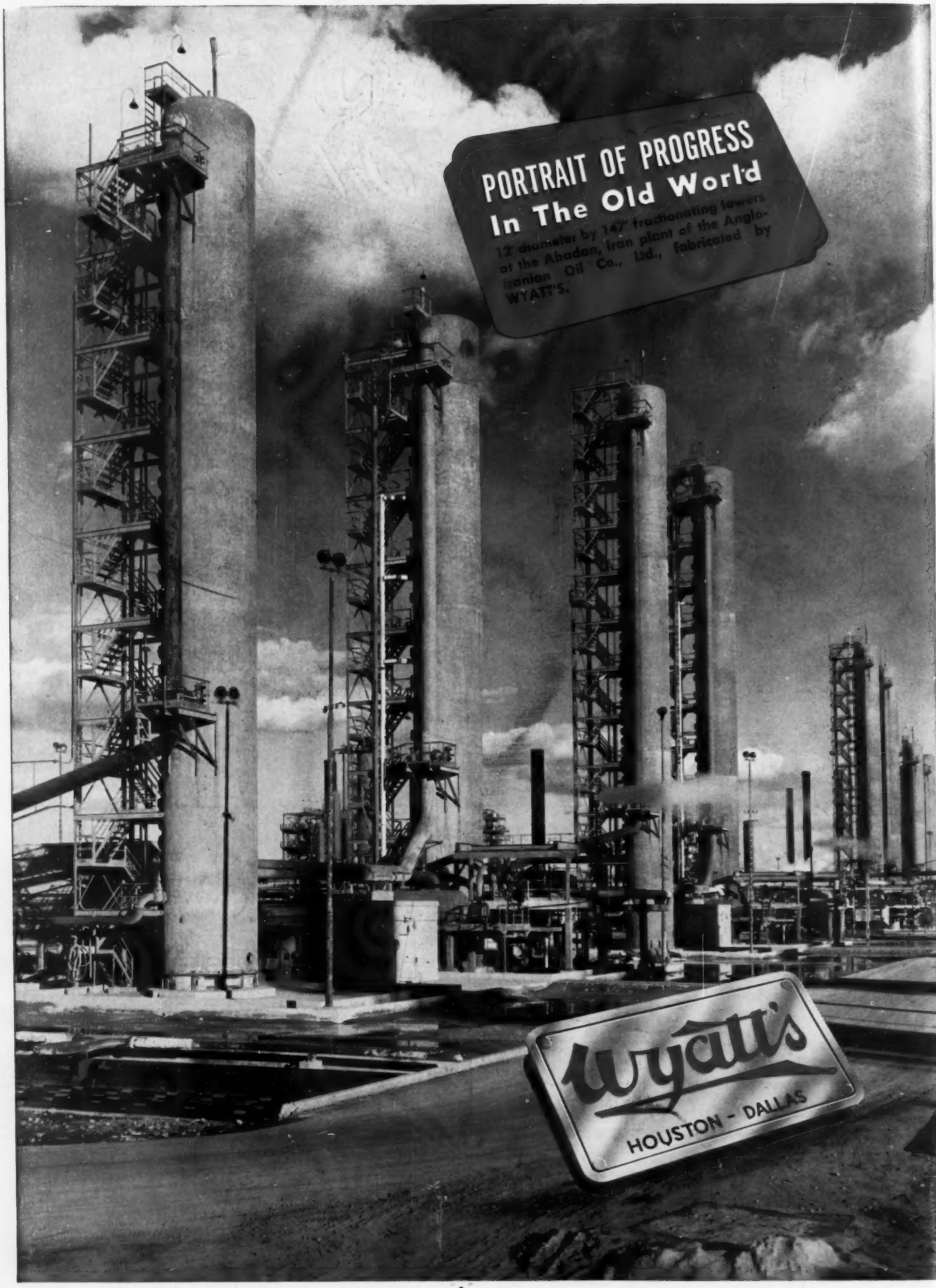
PORTRAIT OF PROGRESS
In The Old World
12' diameter by 147' fractionating towers at the Abadan, Iran plant of the Anglo-Iranian Oil Co., Ltd., fabricated by WYATT'S.
Wyatt's
HOUSTON - DALLAS